

Mode	Data rate (Mbps)	Target application	Receiver sensitivity	Power consumption ('2001)	
				Rx. average	Tx. average
Mode 1.0 (Bluetooth)	1 Mbps		-84 dBm	25 mW	15 mW
Mode 2.0	2.6-3.9 Mbps	Audio	-78 dBm	30 mW	20 mW
Mode 3.0	22-44 Mbps	Video, computer graphics	-69 dBm	95 mW	60 mW

Figure 1

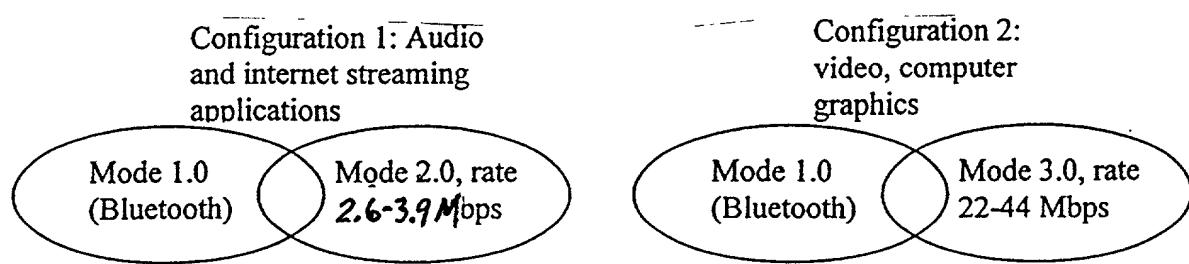


Figure 2

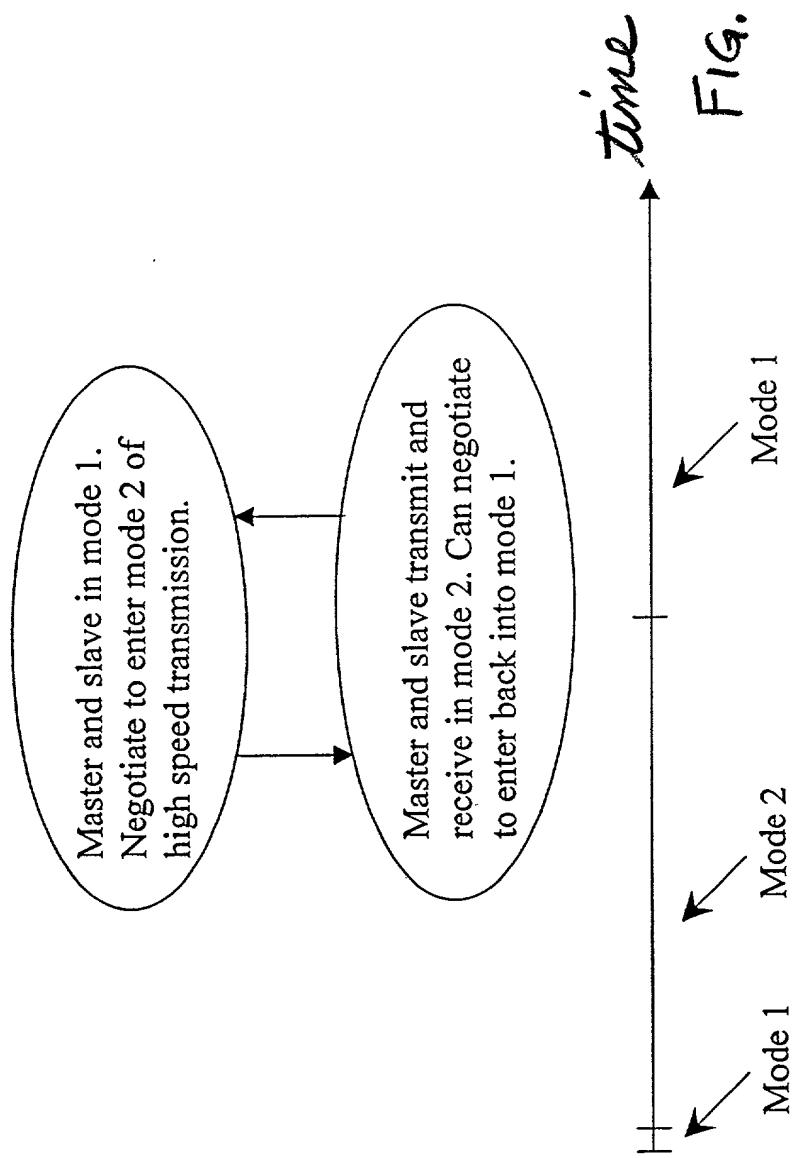
Parameters	Mode 1 (Bluetooth)	Mode 2
Frequency hopping	1600 Hz	Same as Bluetooth
Filter spectrum		Same as Bluetooth 16, 64 QAM
Modulation	GFSK	16, 64 QAM
Maximum data rate	1 Mbps	2.6, 3.9 Mbps
Acquisition		Using mode 1 then switch to mode 2
Transmit power	0 dBm	0 dBm, 6 dBm
Distance	10 m.	10 m.
Nominal packet error rate	10 %	10 %
Margin + Noise figure	37 dB	37 dB
Receiver sensitivity	-84 dBm	-84, -78 dBm
Coding	ARQ	ARQ + convolutional code across packets

Figure 3

Frequency offset	Transmit power
+/- 550 kHz	-20 dBc
$ M-N = 2$	-20 dBm
$ M-N \geq 3$	-40 dBm

Figure 4

Fig. 5



LSB	20 symb.	32 symb.	27 symb.	0-1780 symb.	MSB
Preamble 30.8 μ sec.	Sync. Word 49.2 μ sec.	Header 41.5 μ sec.		Payload 0-2738 μ sec.	
20 bits	64 bits	54 bits		0-7120 bits for 16 QAM 0-10680 bits for 64 QAM	

Figure 6

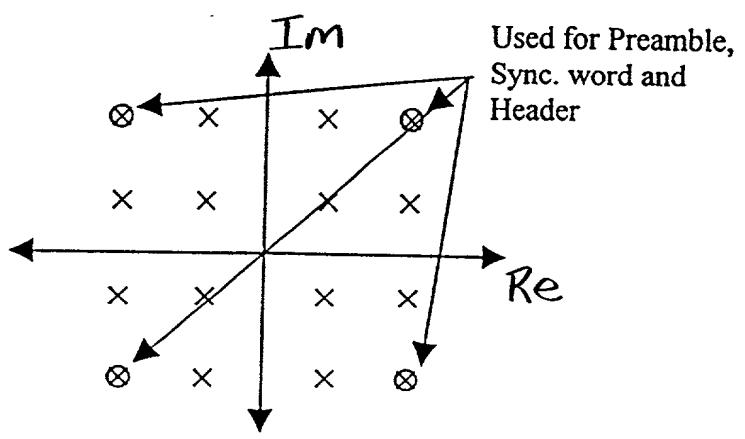


Figure 6A

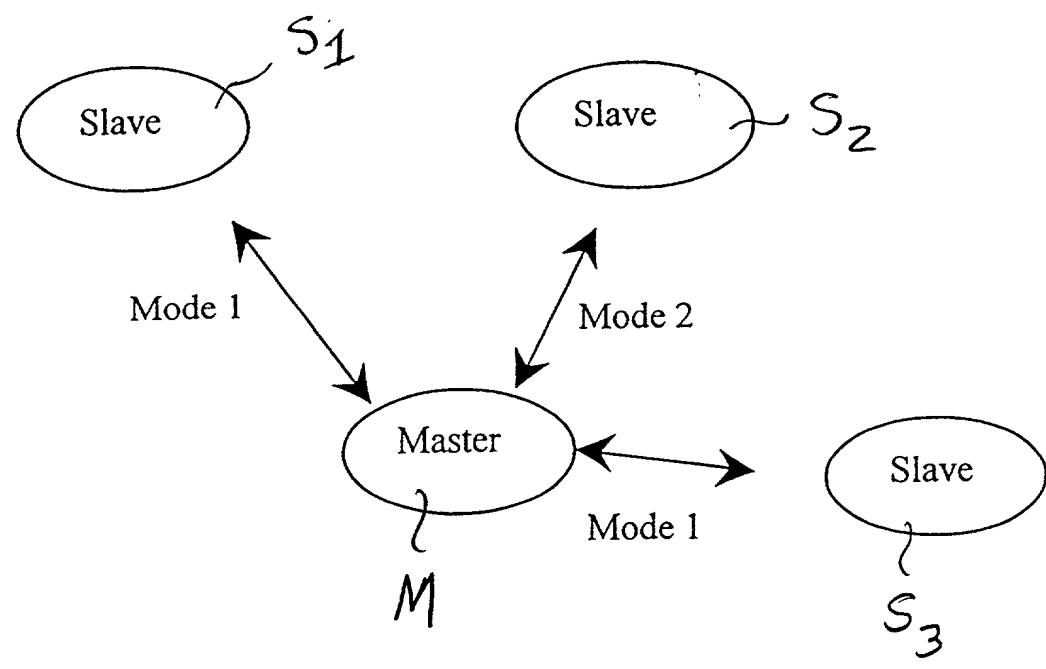


Figure 7

M	S_1	M	S_2	M	S_3	M	S_1	M	S_2	M	S_3
Mode 1	Mode 1	Mode 2	Mode 2	Mode 1	Mode 1	Mode 1	Mode 1	Mode 2	Mode 2	Mode 1	Mode 1

 time

Figure 8

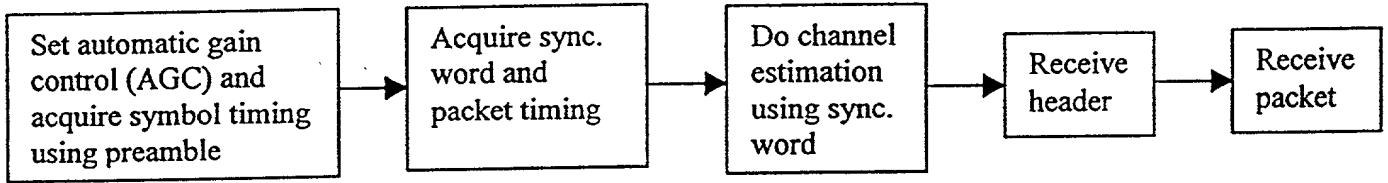


Figure 9

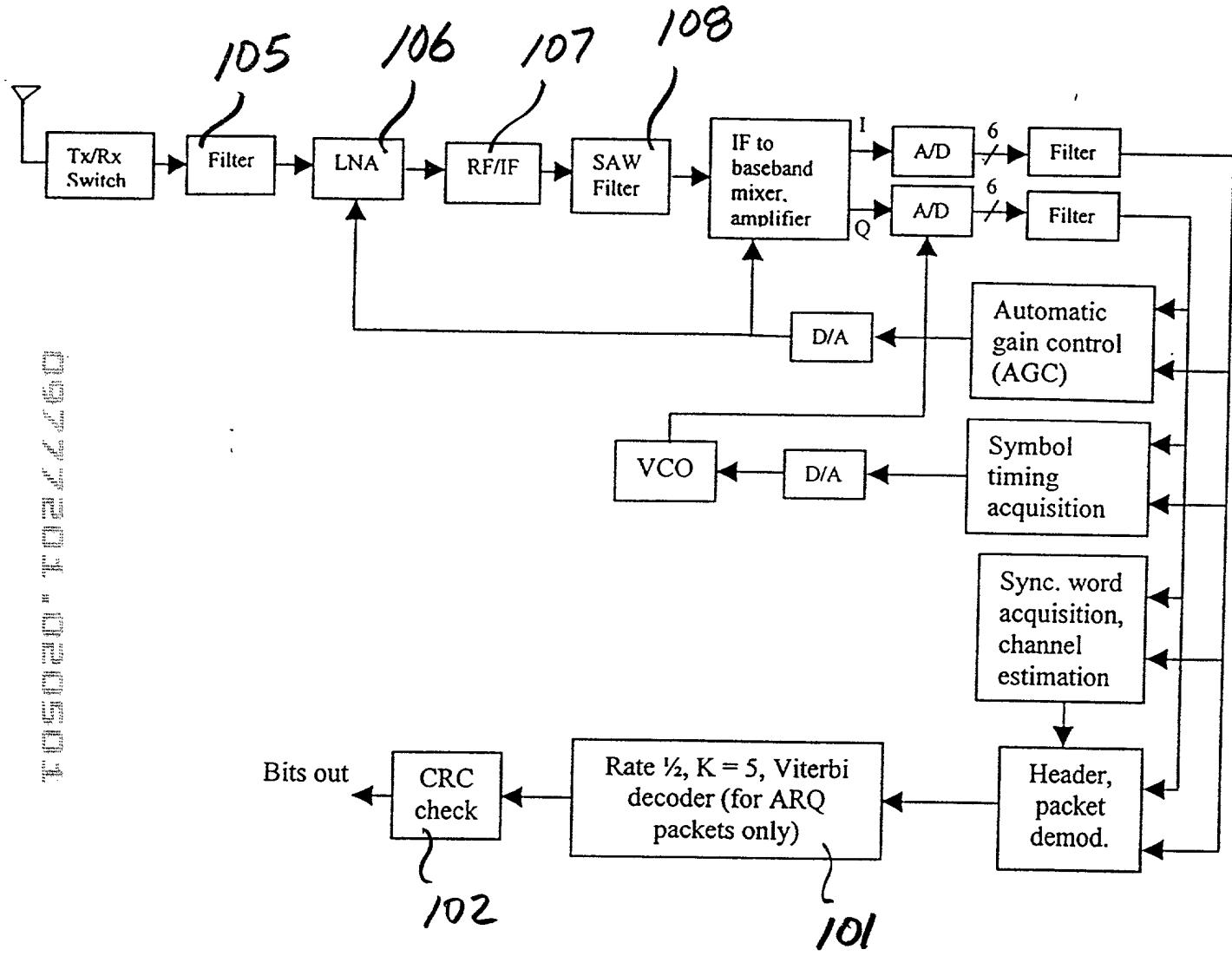


Figure 10

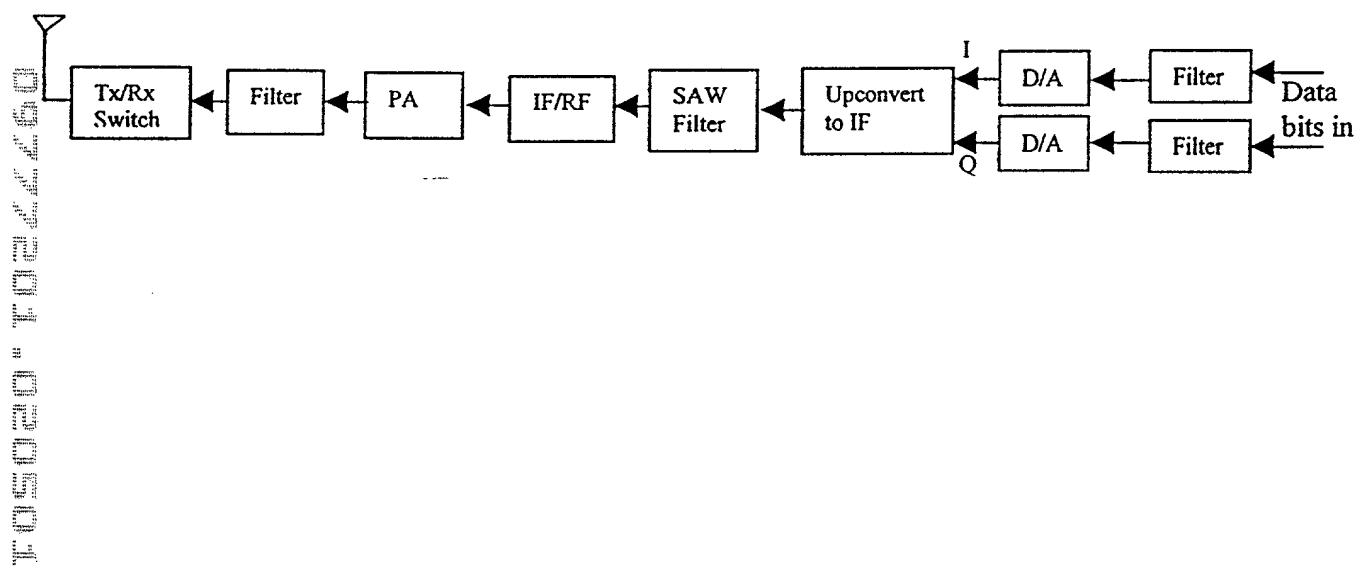


Figure 11

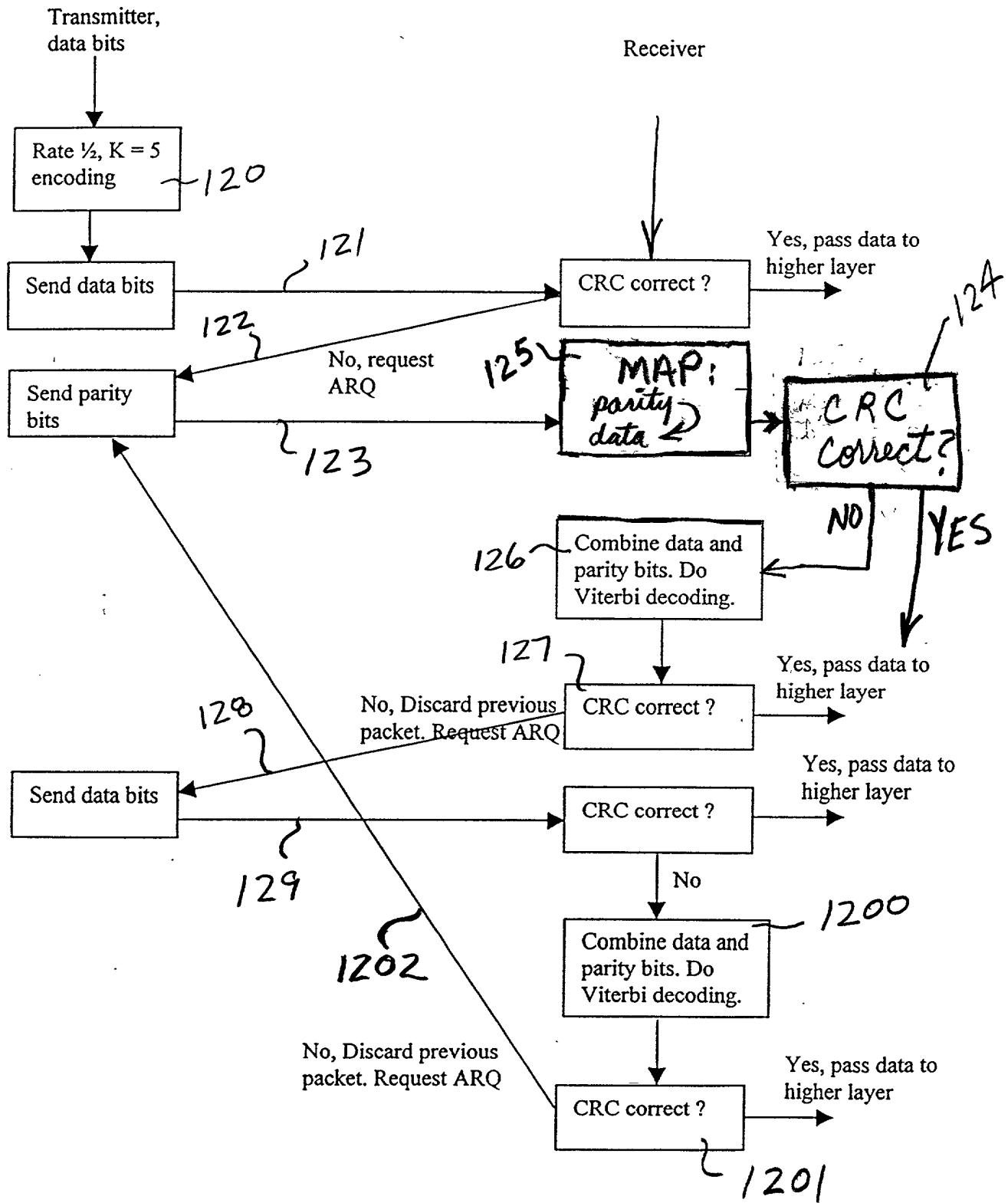


Figure 12

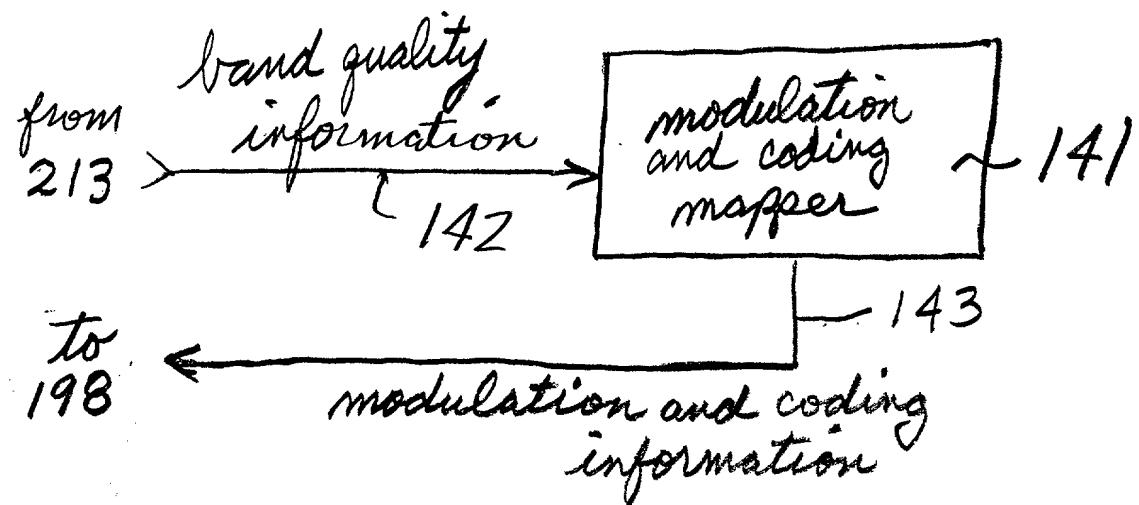


FIG. 14B

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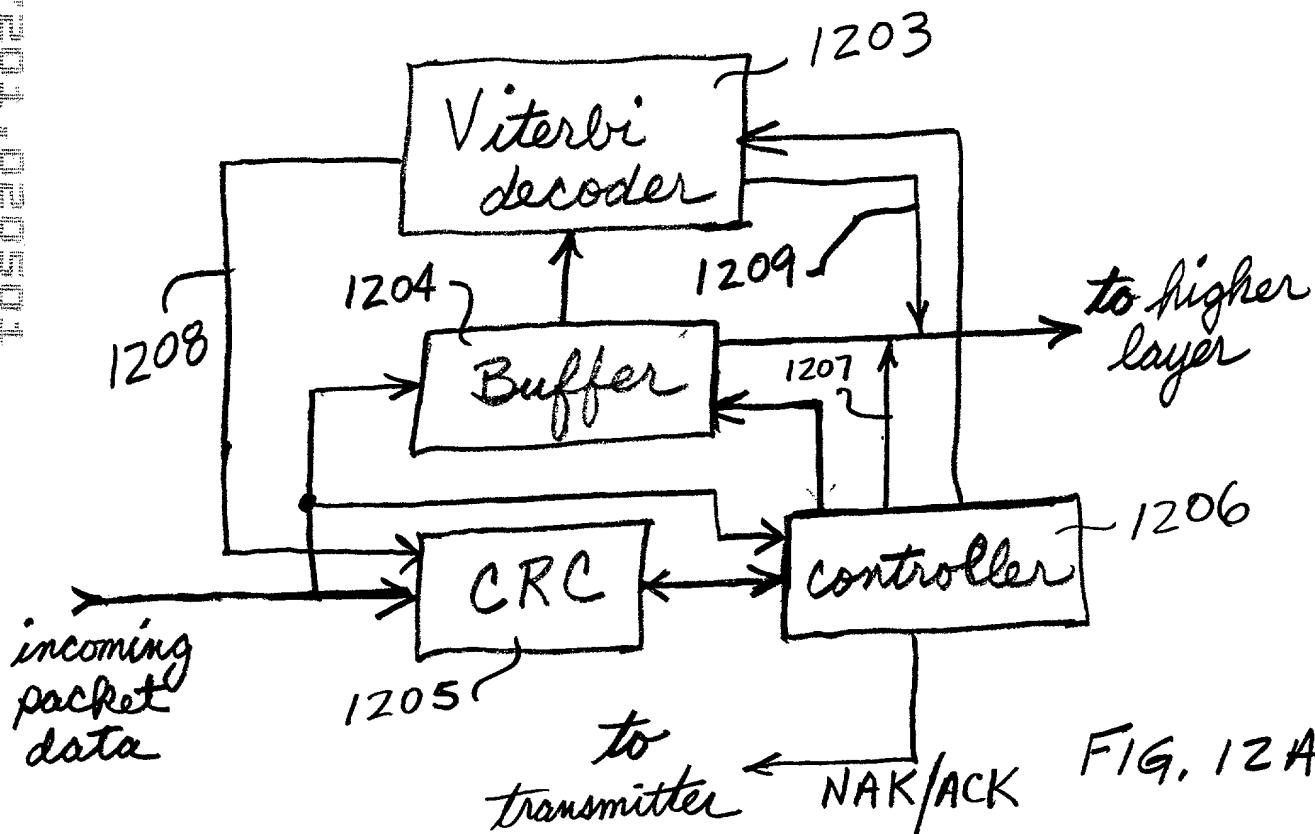
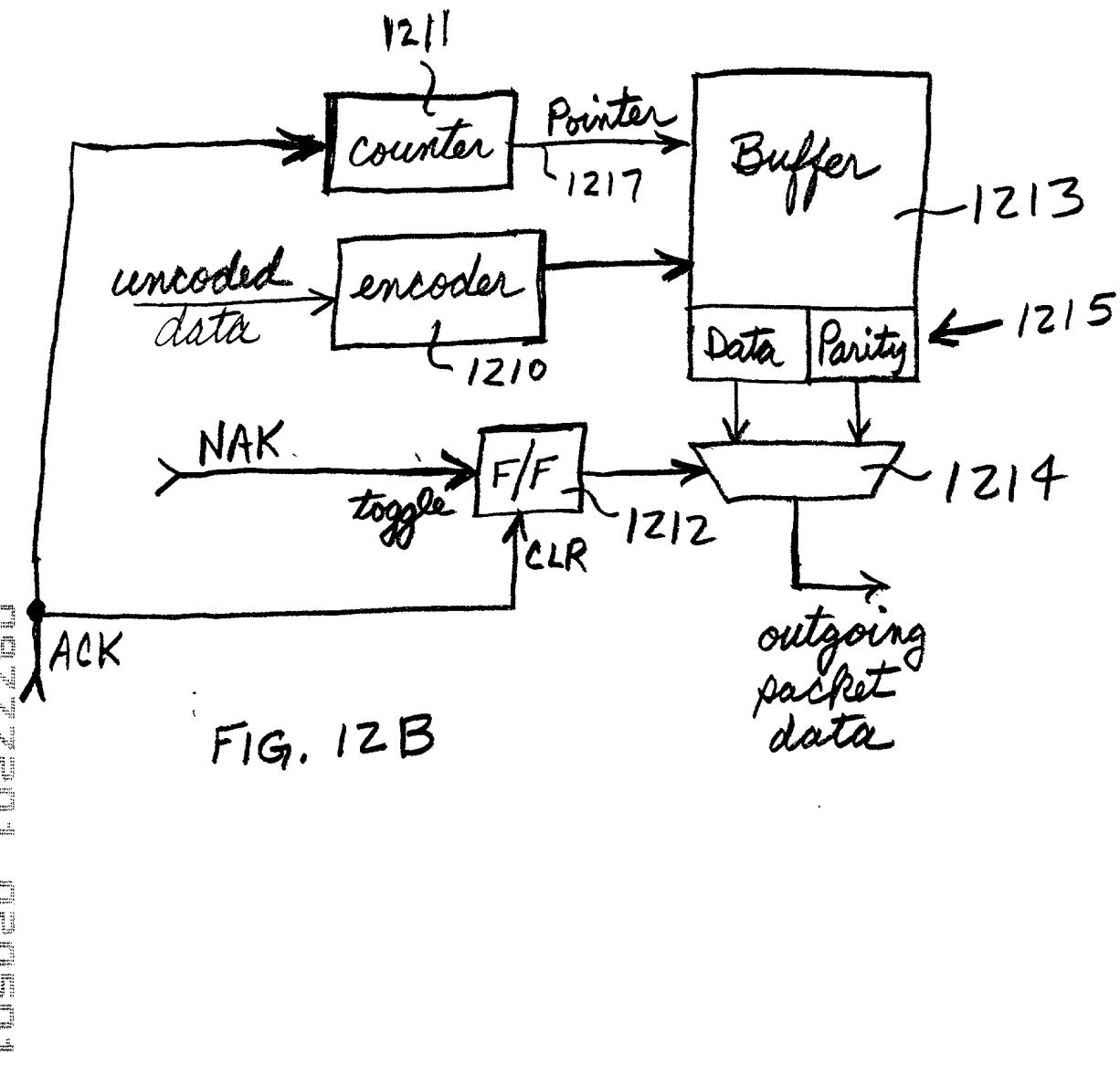


FIG. 12A



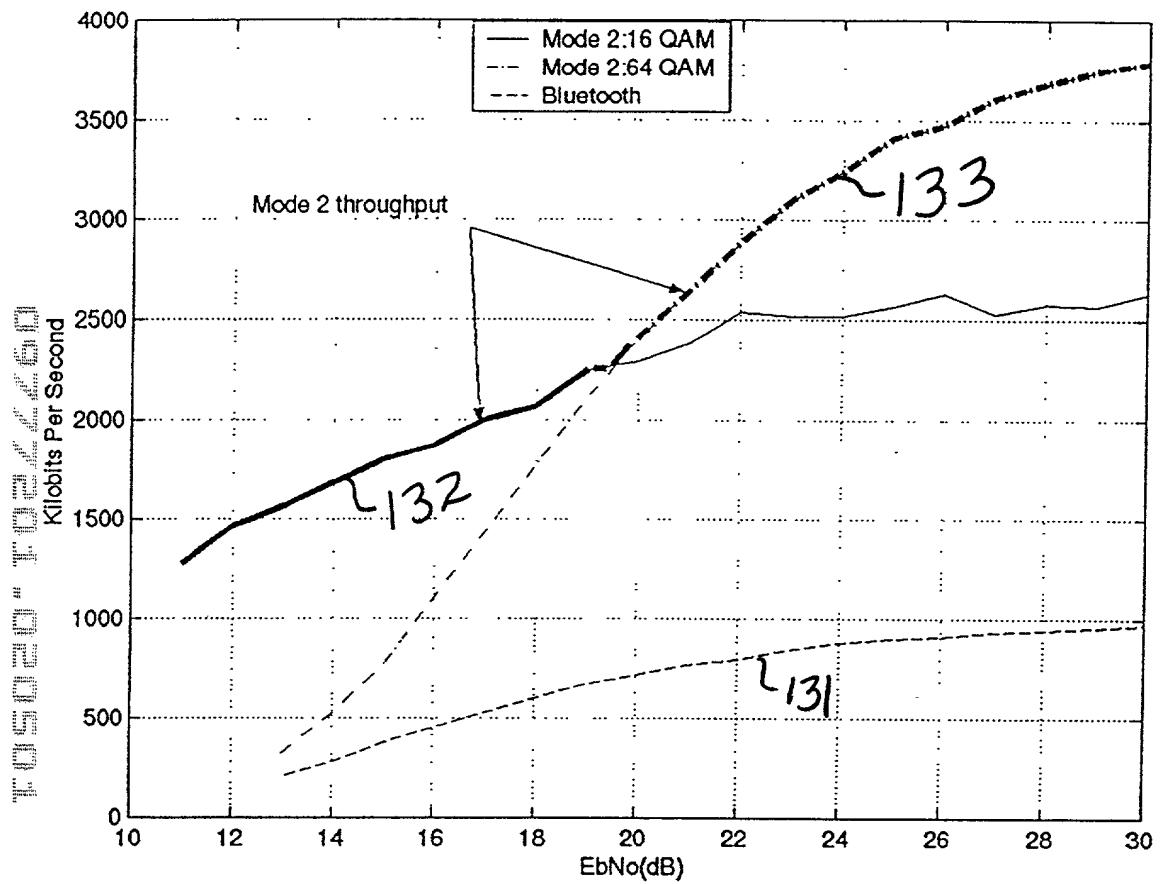


Figure 13

Parameters	1	2	3	4	5
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	QPSK	QPSK	16 QAM	16 QAM	16 QAM
Scrambling code length	256	256	256	256	256
Physical data rate	22 Mbps	22 Mbps	44 Mbps	44 Mbps	44 Mbps
Coding	Rate $\frac{1}{2}$, Turbo (SCCC)	None	Rate $\frac{1}{2}$, Turbo (SCCC)	Rate $\frac{3}{4}$, Turbo (SCCC)	None
ARQ	Optional	Optional	Optional	Optional	Optional
Maximum data rate	11 Mbps	22 Mbps	22 Mbps	33 Mbps	44 Mbps
Transmit power	-1 dBm	8 dBm	4 dBm	8 dBm	15 dBm
Distance	10 m.	10 m.	10 m.	10 m.	10 m.
Bit error rate	1e-8	1e-8	1e-8	1e-8	1e-8
Packet error rate	1e-4	1e-4	1e-4	1e-4	1e-4
Margin+Noise figure	37 dB	37 dB	37 dB	37 dB	37 dB
Receiver sensitivity	-85 dBm	-76 dBm	-80 dBm	-76 dBm	-69 dBm
Frequency diversity	Band selection	Band selection	Band selection	Band selection	Band selection
SYMBOL RATE	11 Msps	11 Msps	11 Msps	11 Msps	11 Msps
SPREADING	11 Mcps	11 Mcps	11 Mcps	11 Mcps	11 Mcps

Figure 14

<u>Max. data rate</u>	Modulation	Symbol rate	Coding	Spreading
18	18 Mbps	QPSK	18 Msps	rate 1/2
19	36 Mbps	QPSK	18 Msps	rate 1
20	36 Mbps	16 QAM	18 Msps	rate 1/2
21	54 Mbps	16 QAM	18 Msps	rate 3/4
22	72 Mbps	16 QAM	18Msps	rate 1

FIG. 14A

Parameters	6	7	8	9	10
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	QPSK	QPSK	QPSK	QPSK	QPSK
Scrambling code length	256	256	256	256	256
Physical data rate	22 Mbps	22 Mbps	22 Mbps	22 Mbps	22 Mbps
Coding	Rate ½, Turbo	Rate 2/3, Turbo	Rate ¾, Turbo	Rate 4/5, Turbo	Rate 5/6, Turbo
ARQ	Optional	Optional	Optional	Optional	Optional
Maximum data rate	11 Mbps	14.67 Mbps	16.5 Mbps	17.6 Mbps	18.33 Mbps

FIG. 14C

Parameters	11	12	13	14	15	16	17
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK
Scrambling code length	256	256	256	256	256	256	256
Physical data rate	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps
Coding	None	Rate 1/3, Turbo	Rate 1/2, Turbo	Rate 2/3, Turbo	Rate 3/4, Turbo	Rate 4/5, Turbo	Rate 5/6, Turbo
ARQ	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Maximum data rate	33 Mbps	11 Mbps	16.5 Mbps	22 Mbps	24.75 Mbps	26.4 Mbps	27.5 Mbps

FIG. 14D

Frequency offset	Transmit power
fc	0 dBc
+/- 11MHz	-30 dBc
+/- 22 MHz	-50 dBm

Figure 15

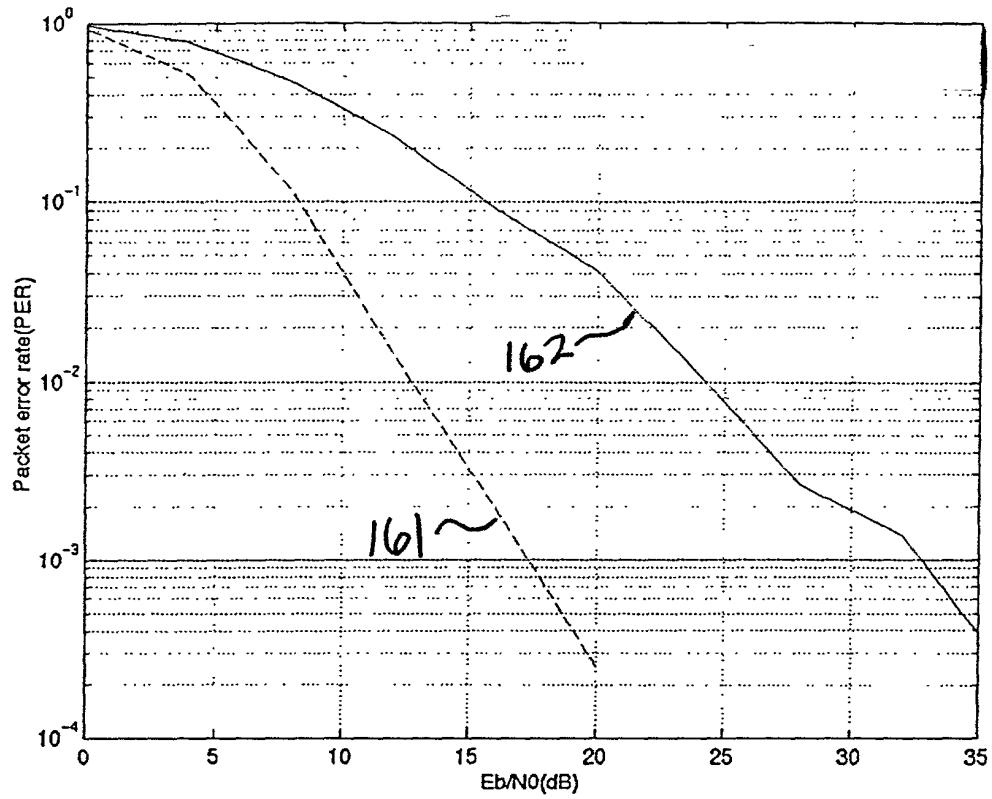


Figure 16

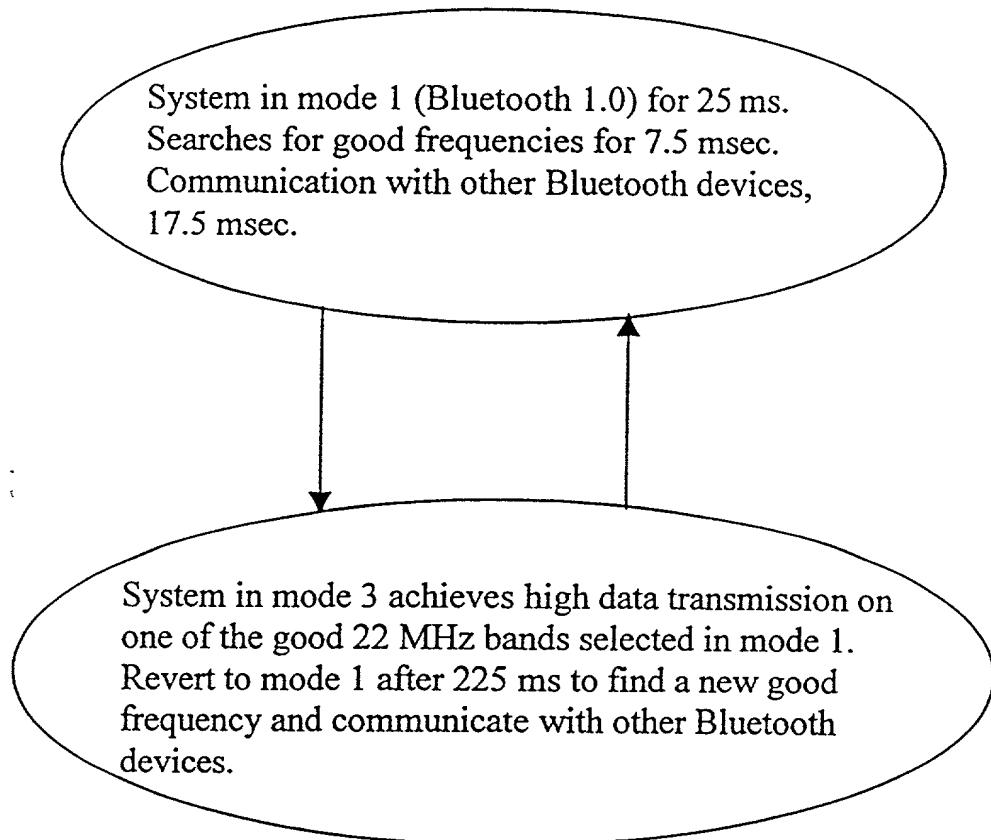


Figure 17

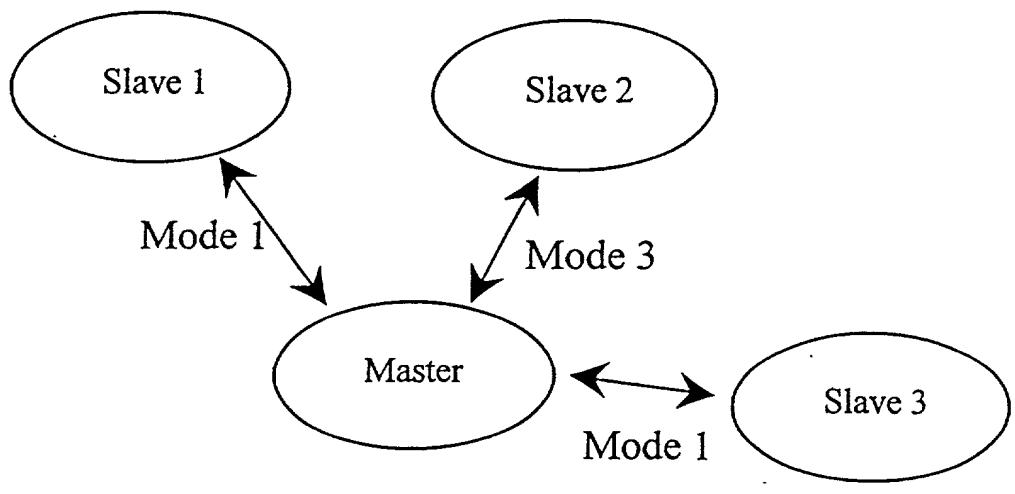


Figure 18

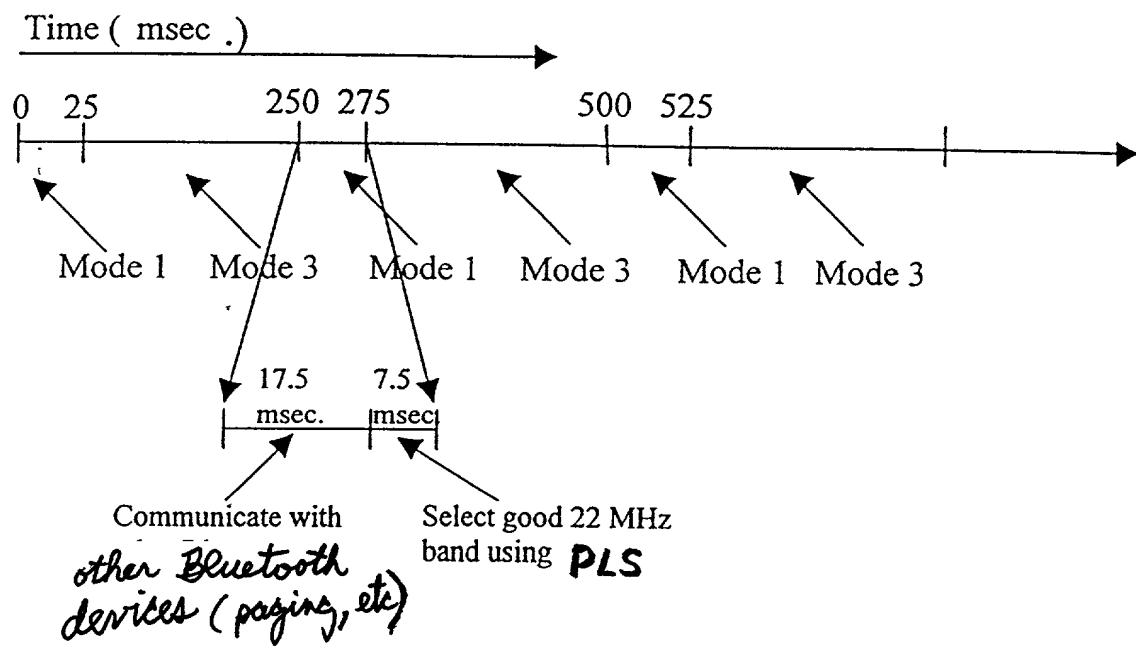
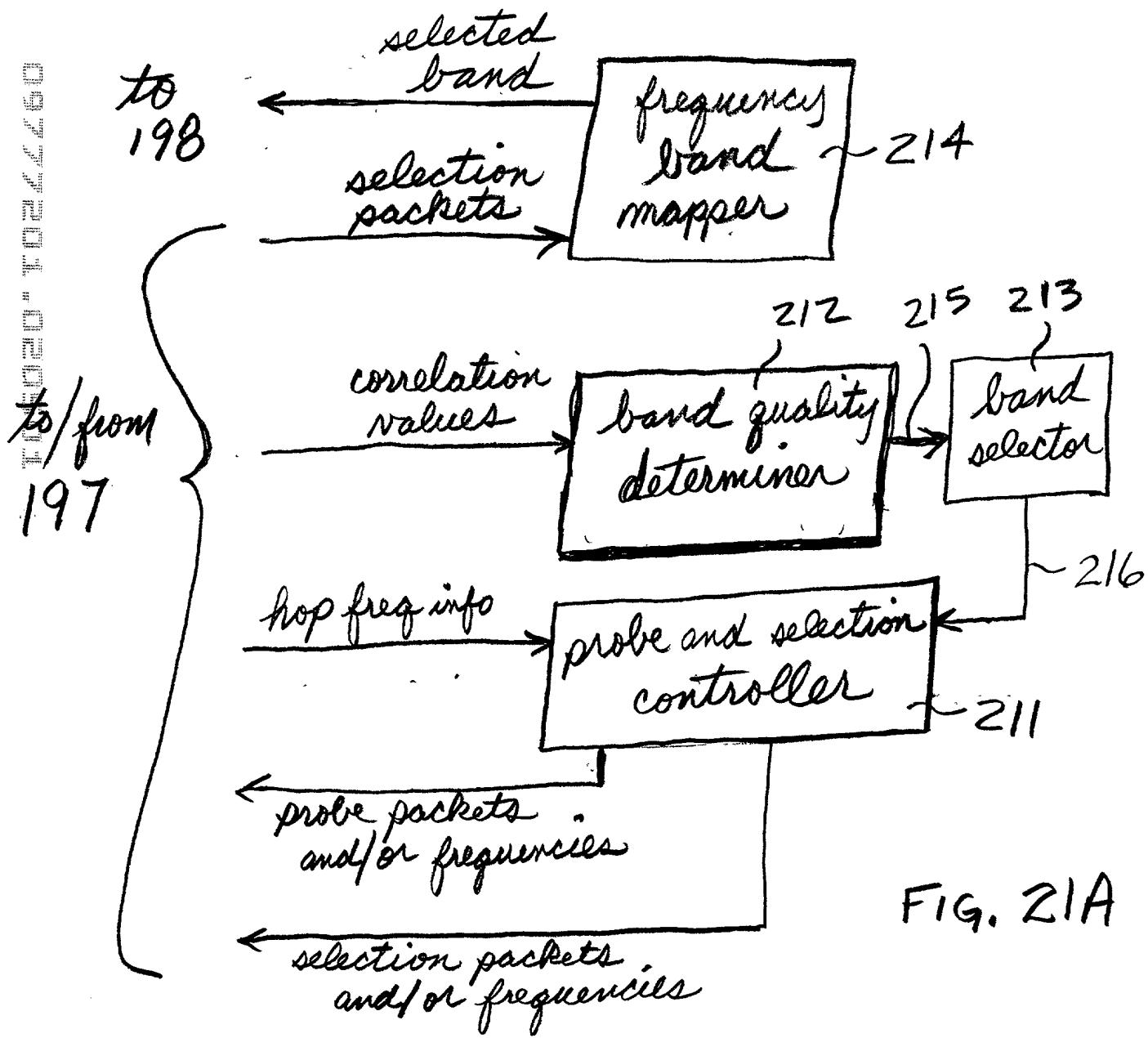
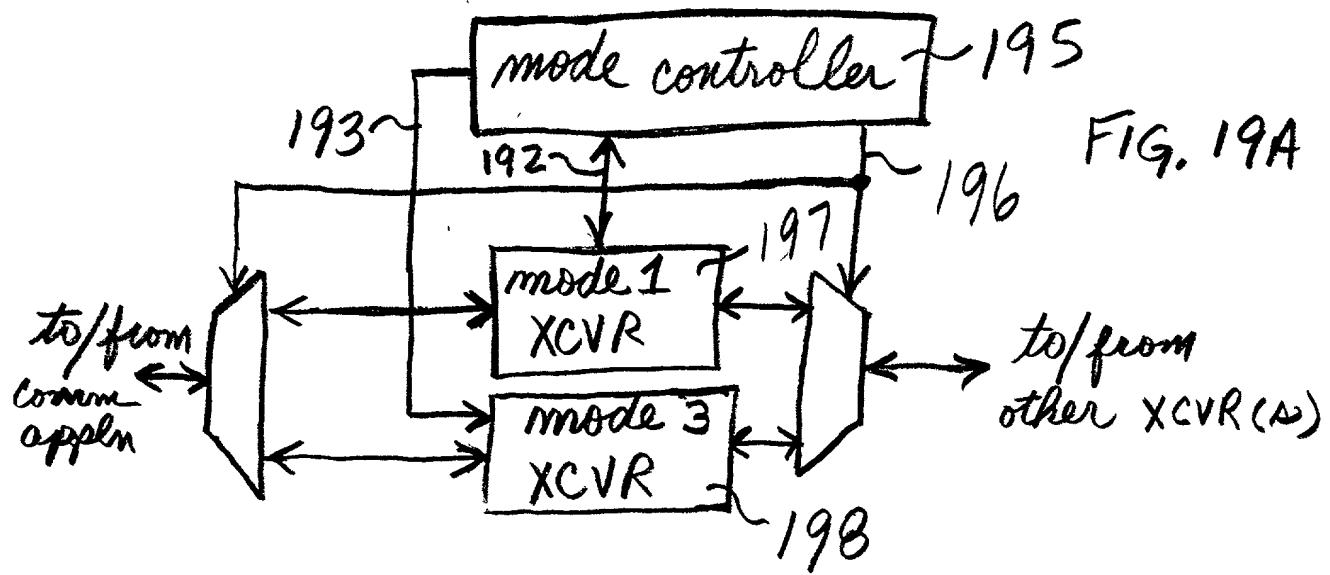


Figure 19



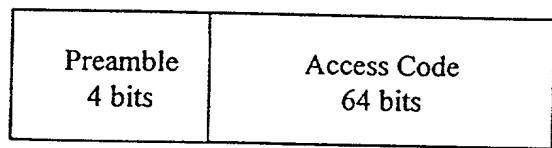


Figure 20

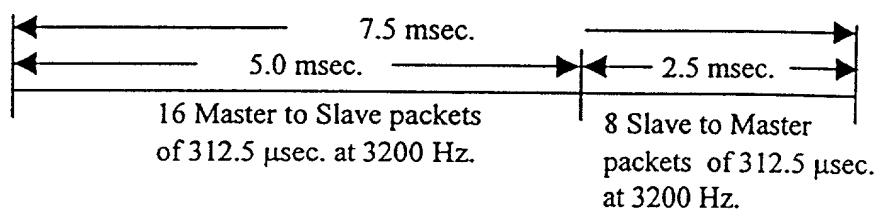


Figure 21

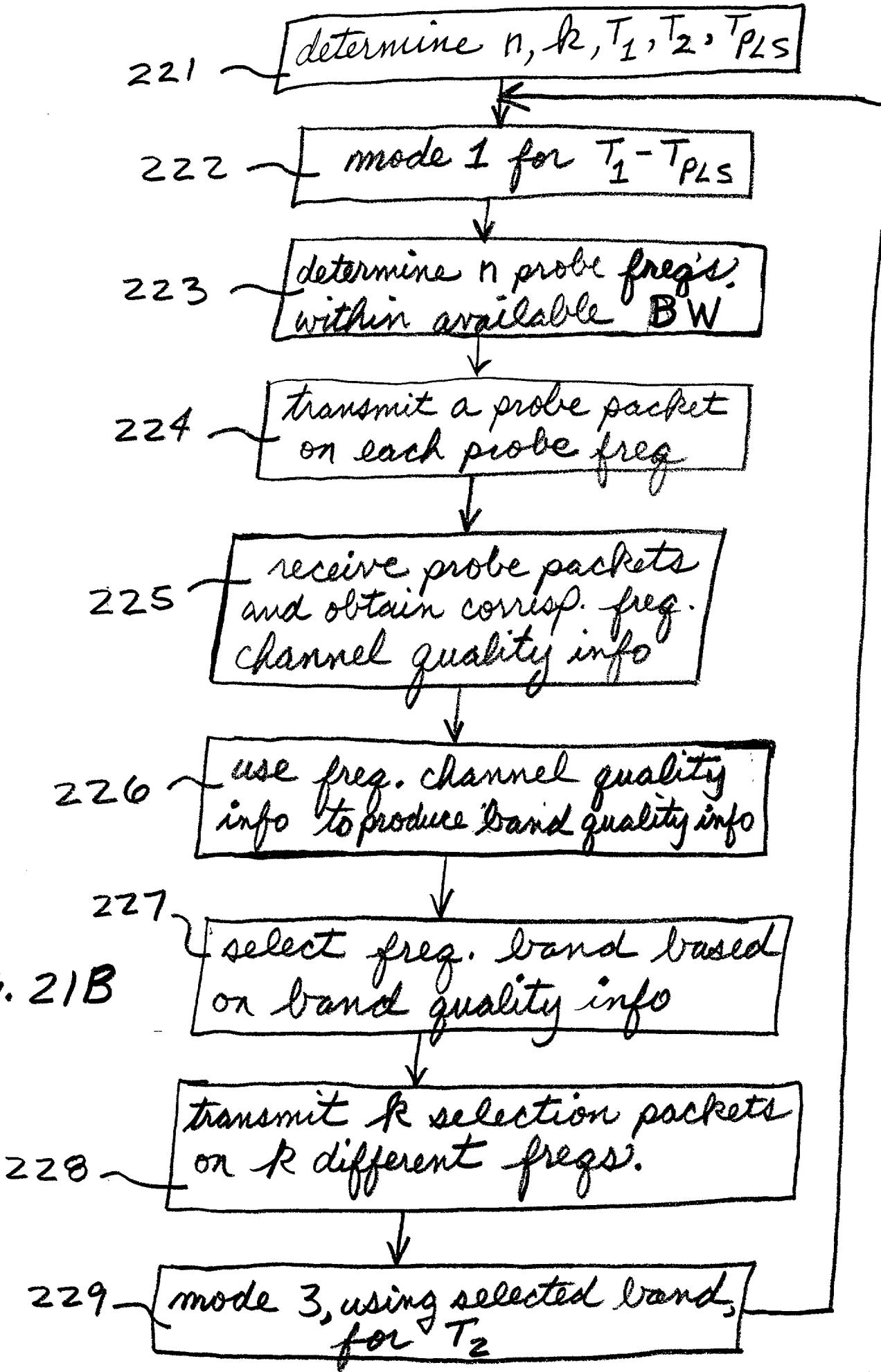


FIG. 21B

Preamble 4 bits	Access Code 64 bits	Channel Edge Frequency Index $6 \times 3 = 18$ bits
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Figure 22

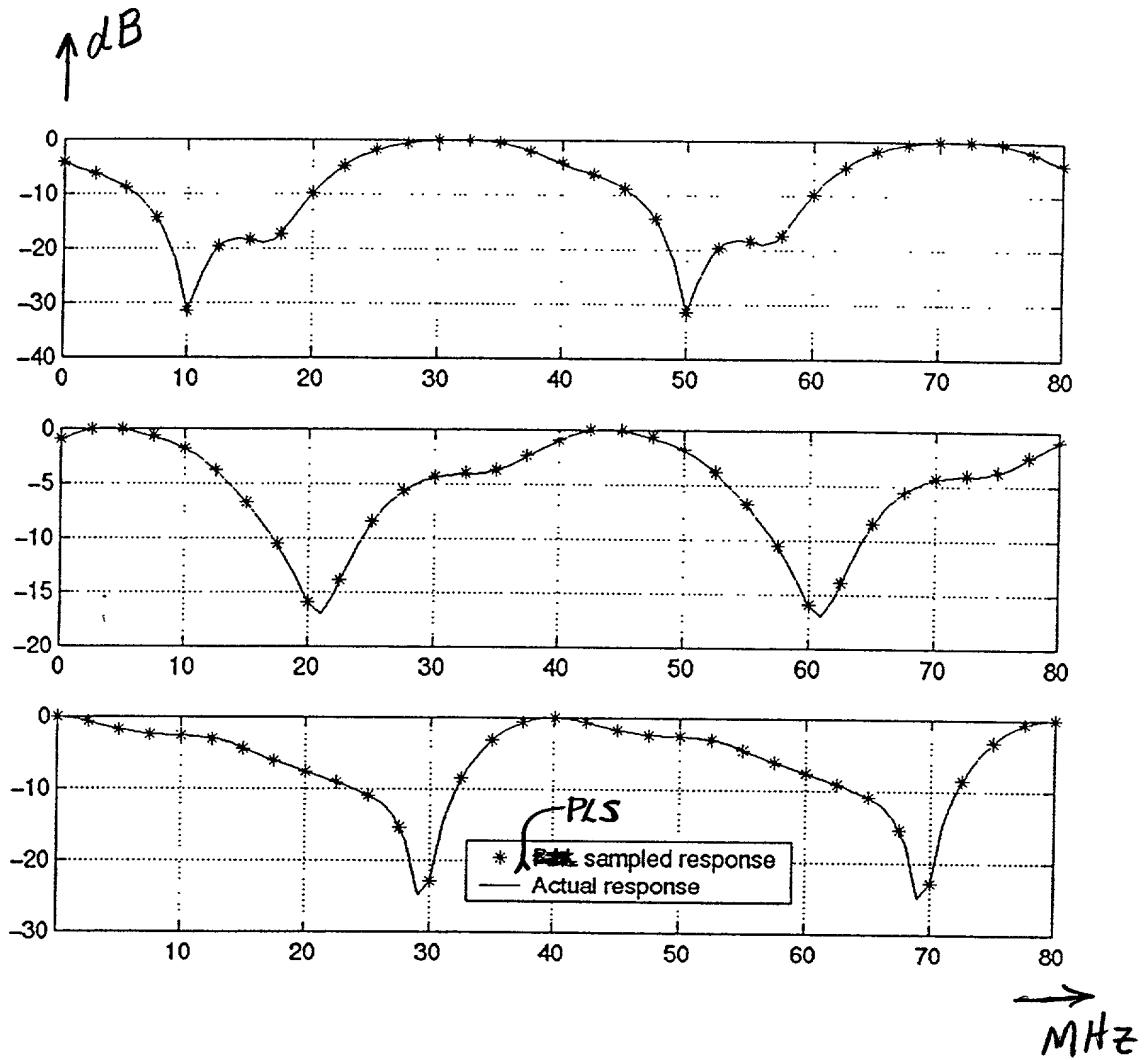
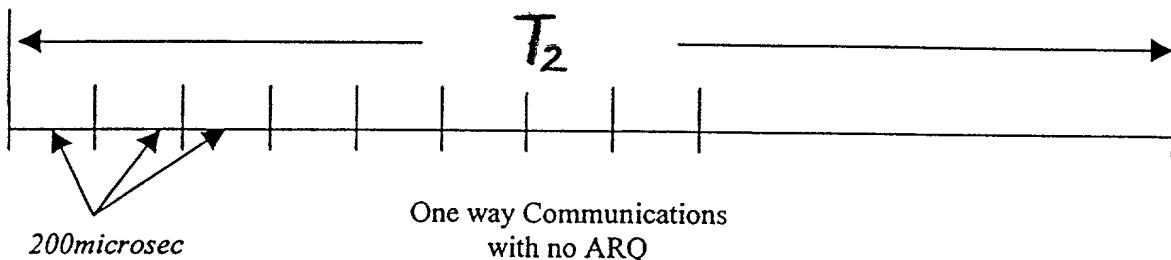


Figure 23

Master to Slave



ARQ Packets from Slave to Master
100 μ sec. in length.

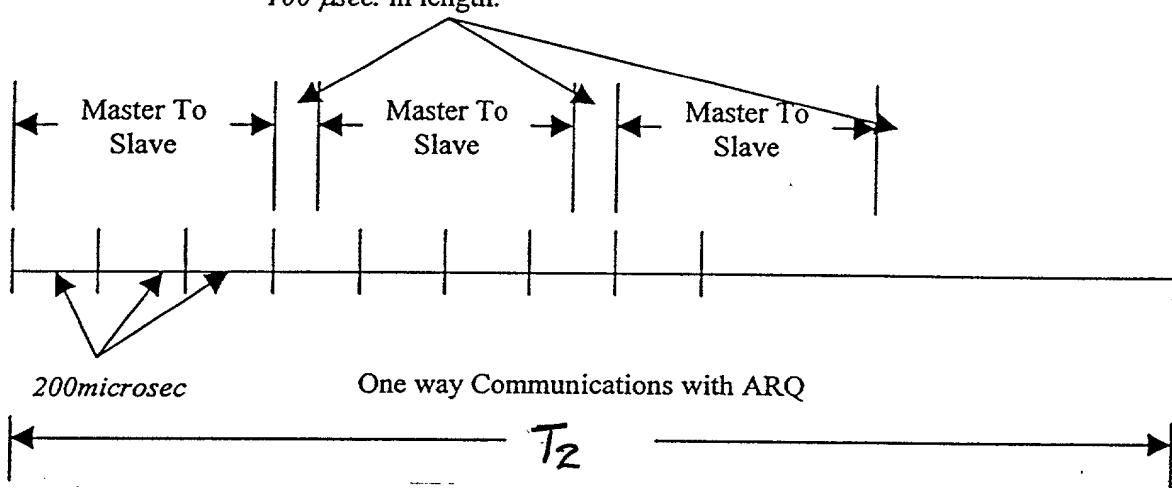


Figure 24

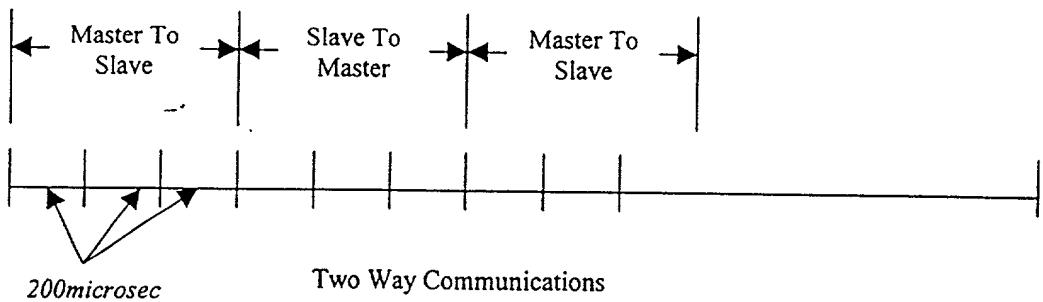


FIG. 24A

	22 symb.	32 symb.	27 symb.	1019 symb.		
100 μ sec turn around time	Preamble 2 μ sec	Sync. Word 2.9 μ sec	Header 2.45 μ sec	Payload (100 bits), CRC	repetition coded	100 μ sec turn around time
	44 bits	64 bits	54 bits	32 bits		

A horizontal double-headed arrow at the bottom spans the width of the "Payload (100 bits)" and "CRC" columns and is labeled "100 μ sec ARQ packet length".

FIG. 25A

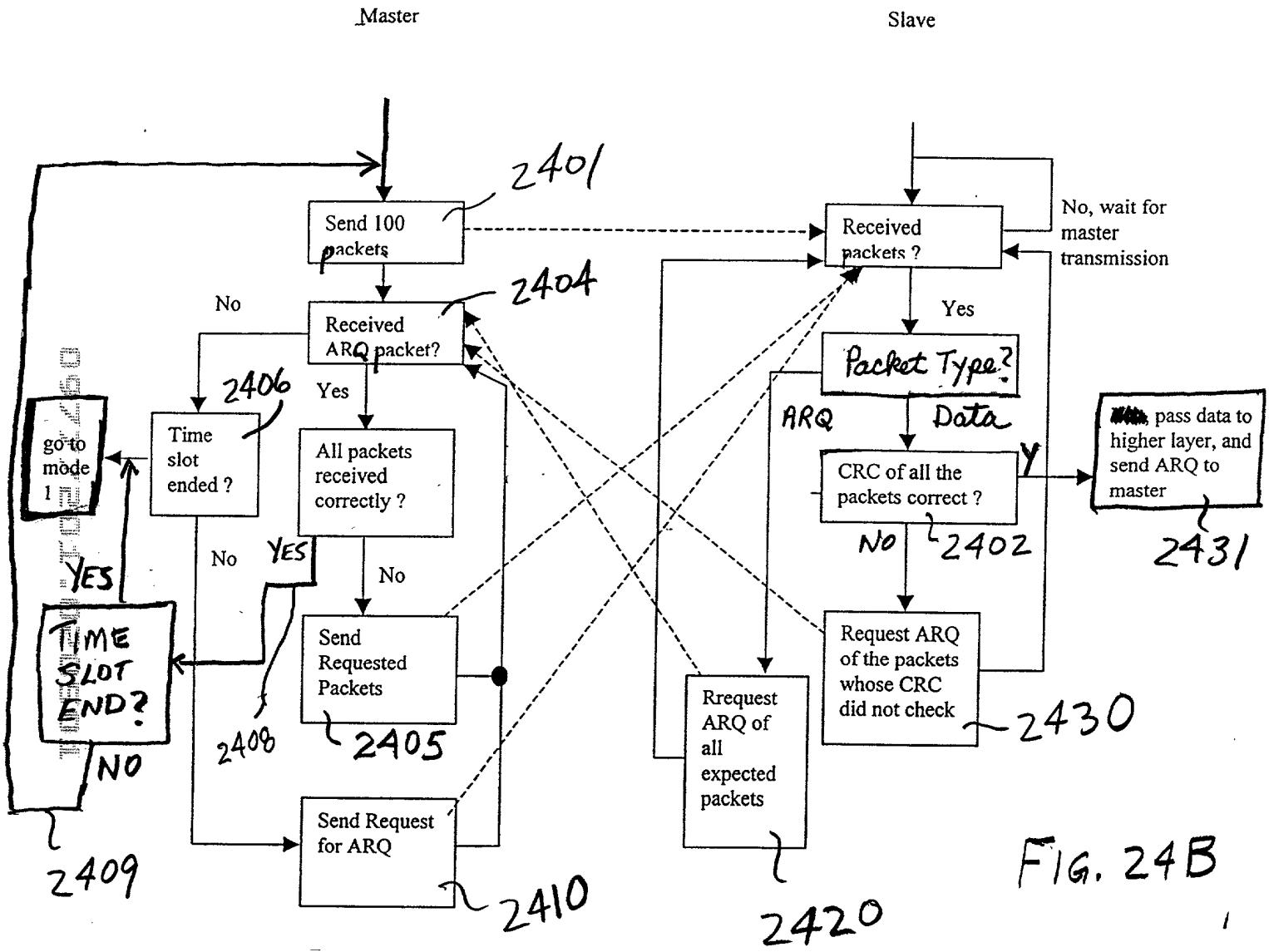


FIG. 24B

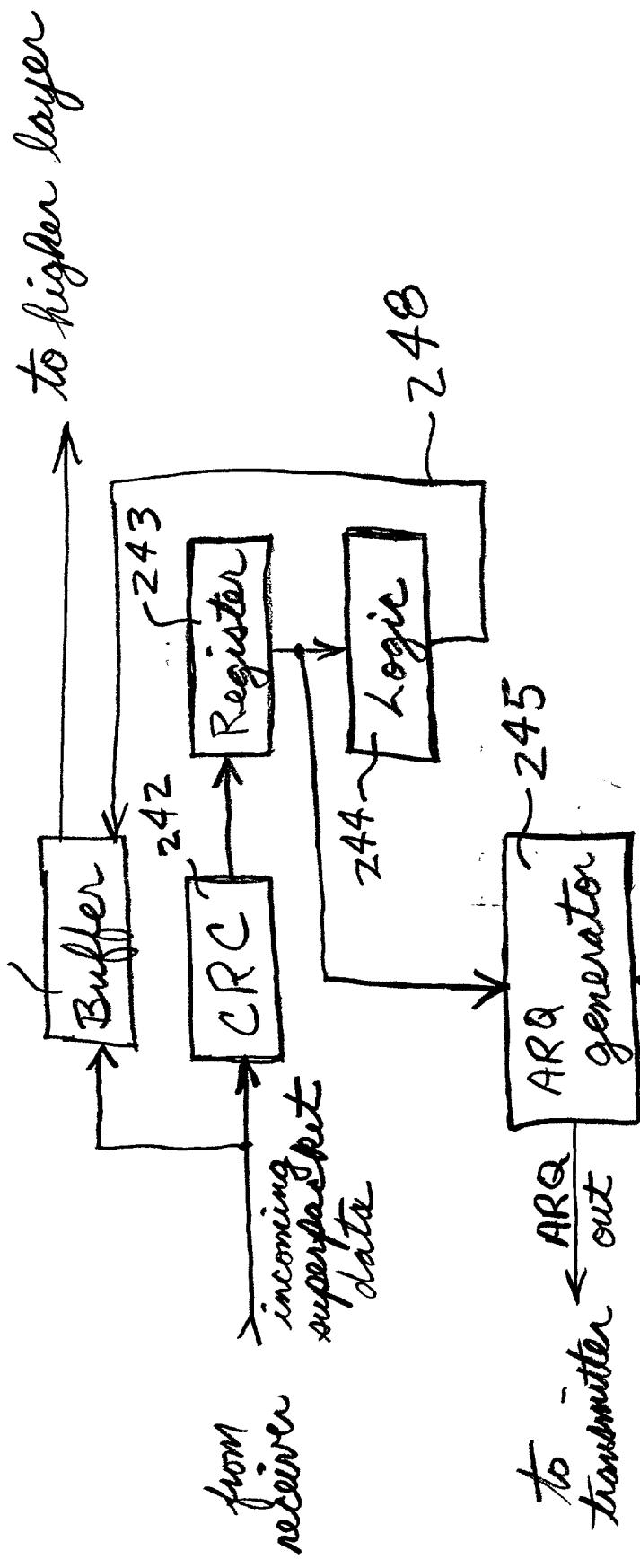
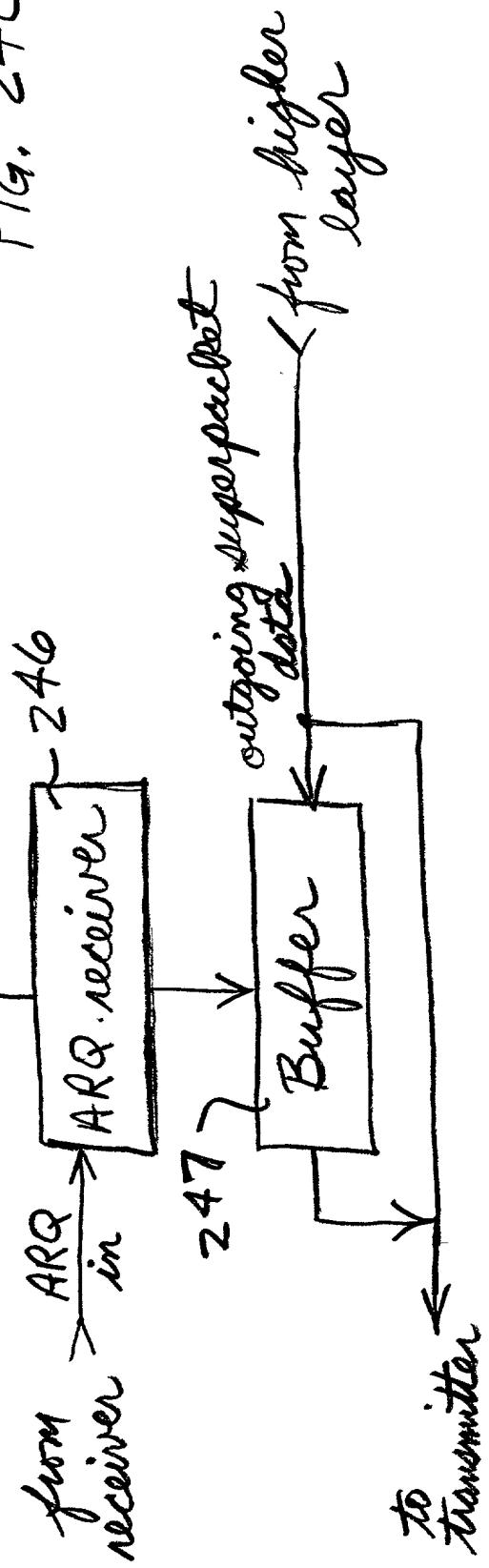


Fig. 24C



to transmitter

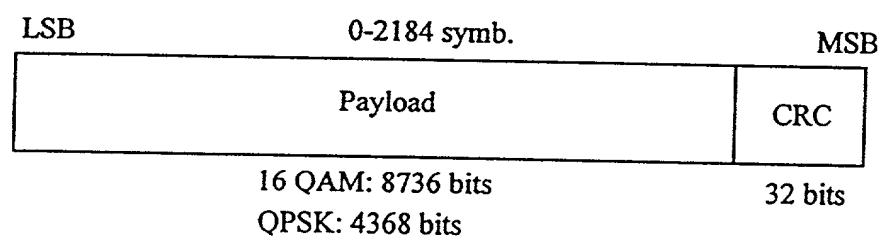


Figure 25

	22 symb.	32 symb.	27 symb.
Preamble		Sync. Word	Header
2 μ sec.		2.9 μ sec.	2.45 μ sec

44 bits 64 bits 54 bits

Figure 26

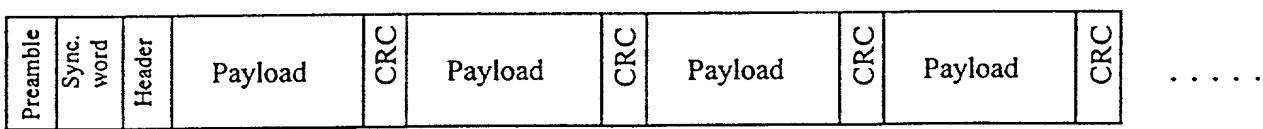


Figure 27

MPEG2 HDTV Video transmission using Mode 3	
Video data rate	18 Mbps
Video frames/sec	24
Video frames/Mode 3 slot	6
Mode 3 data rate	44 Mbps, 11 MSPS
Coding	Rate $\frac{1}{2}$, Turbo
Modulation	16 QAM
Time in Bluetooth mode (T_1 msec.)	25 msec.
Time in Bluetooth mode for other devices	17.5 msec.
Time in Bluetooth mode for PAL	7.5 msec.
Slot time in Mode 3 (T_2 msec.)	225 msec.
Mode 3 packet size	4.4 Kbits
Data bits/packet	4368
CRC bits/packet	32
Mode 3 packet length	200 μ sec.
Number of packets/slot	1030
Length of training sequence	81 symbols, 7.36 μ sec.
Number of packets/training sequence	10
Number of packets/ARQ	100
Number of training sequences/packet	103
Time required to transmit video frames (no ARQ)	$204.5 + 1.5 + 0.76 = 206.76$ msec.
ARQ rate	9 %
Time required to transmit video frames with ARQ	225 msec.

Figure 28

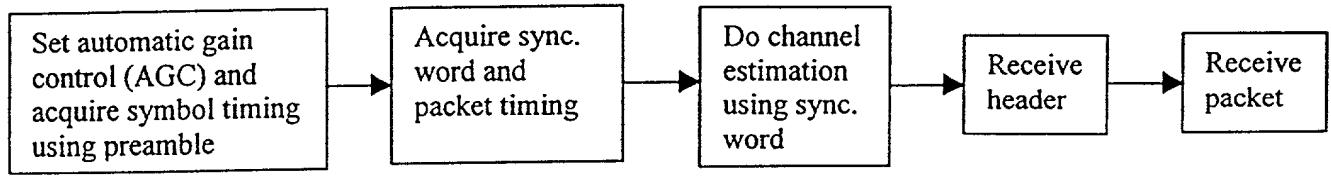


Figure 29

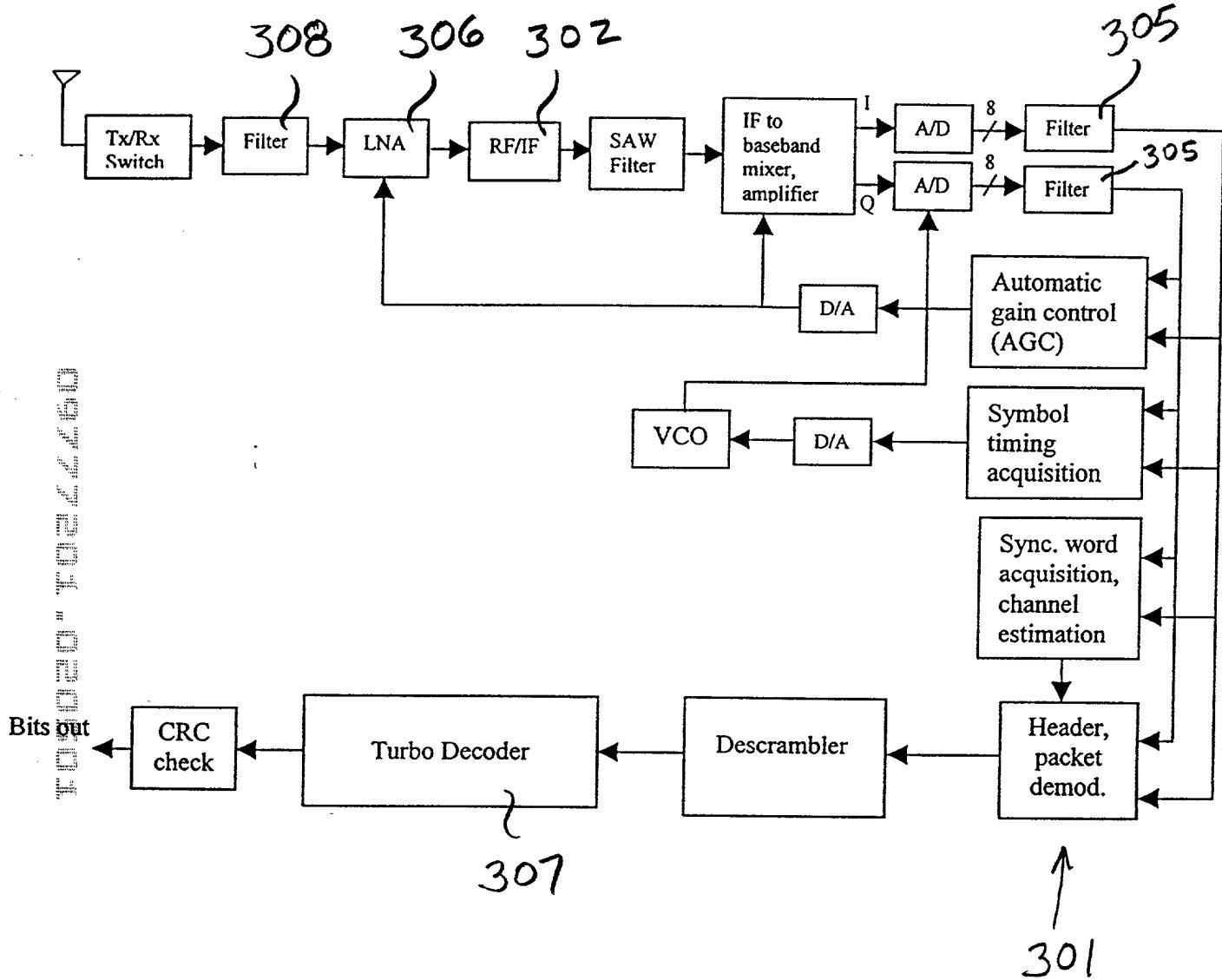


Figure 30

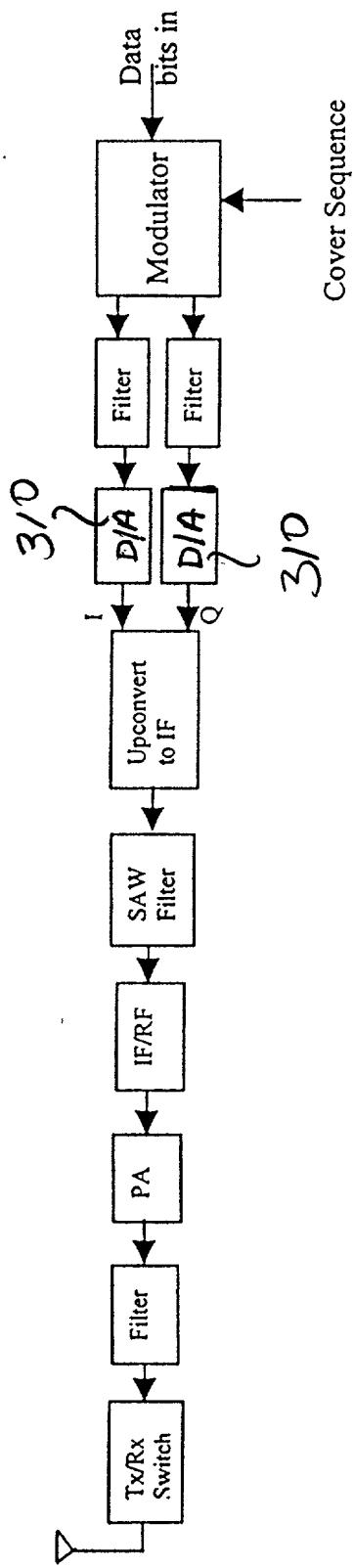


Figure 31

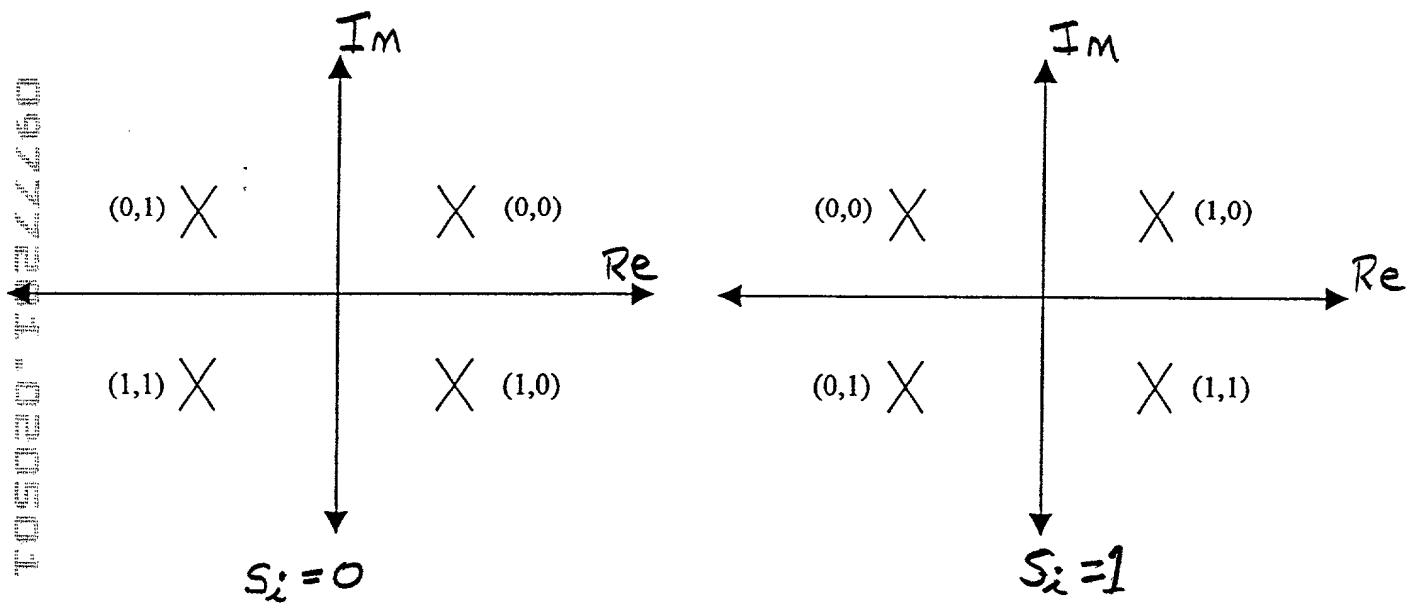


Figure 32

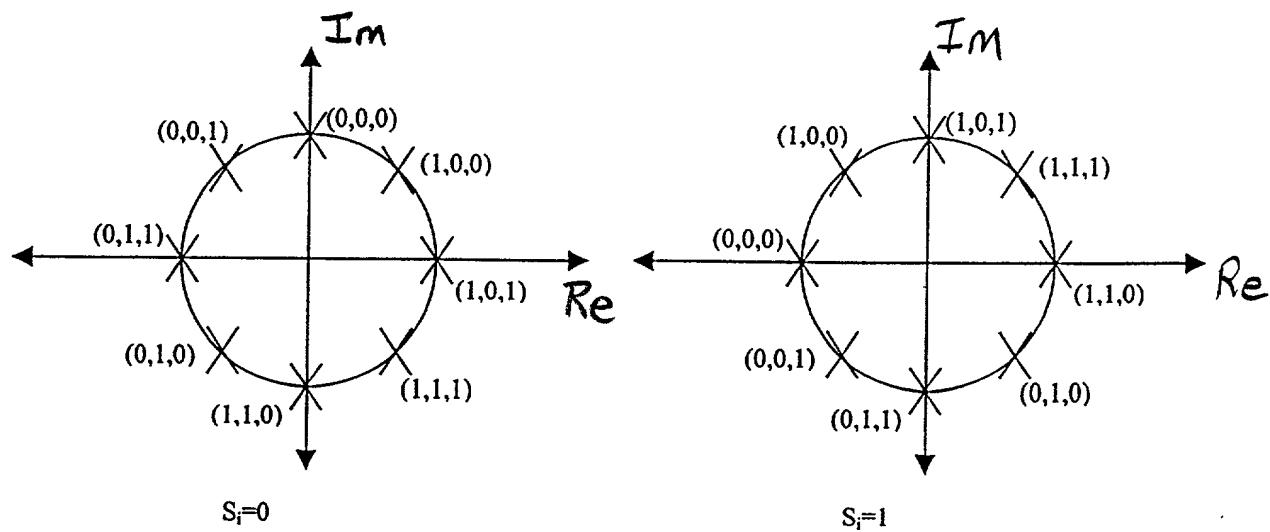
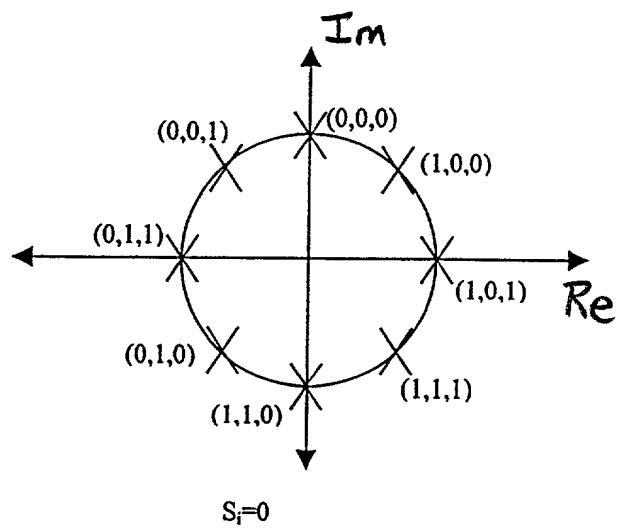


FIG. 32A

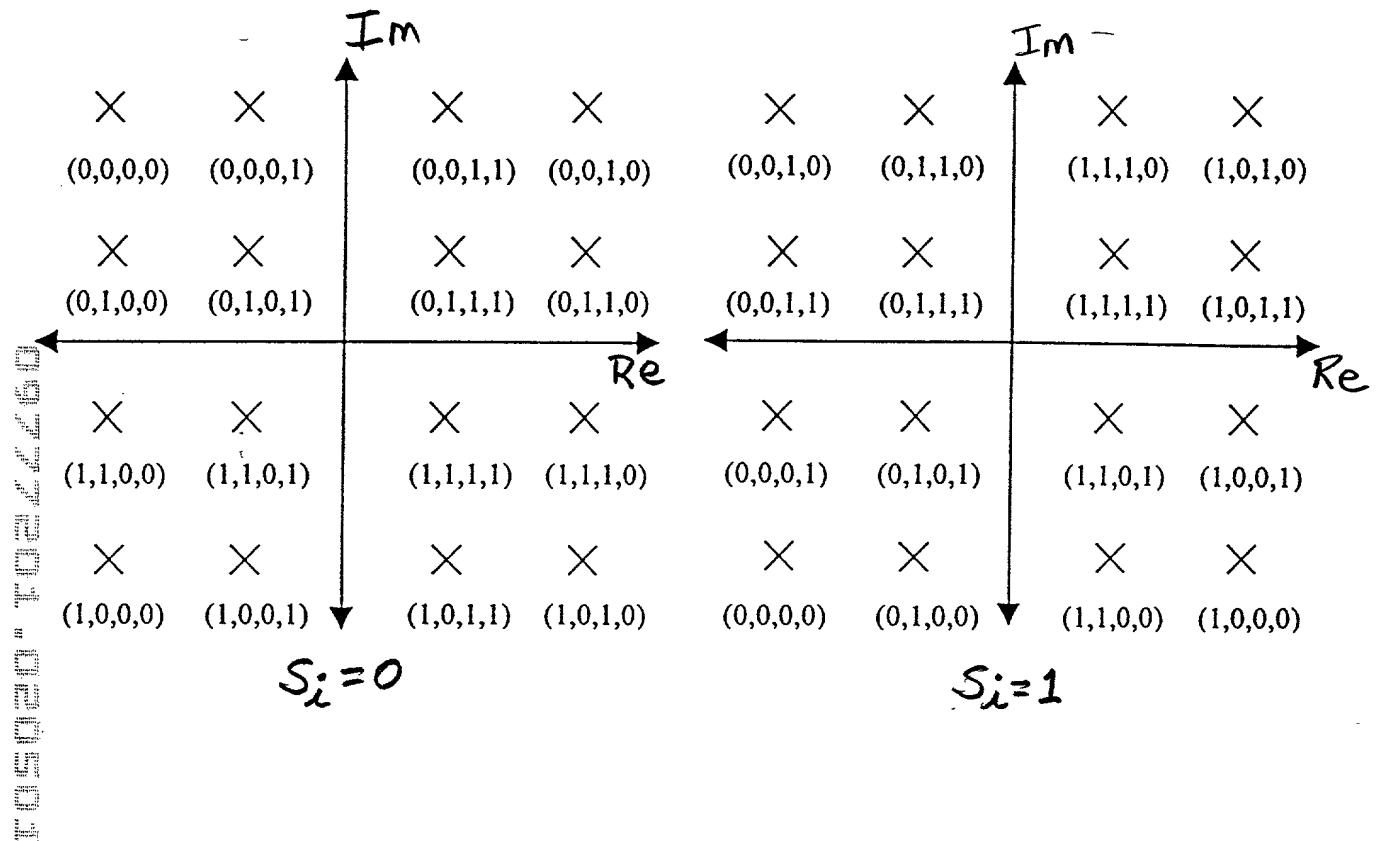


Figure 33

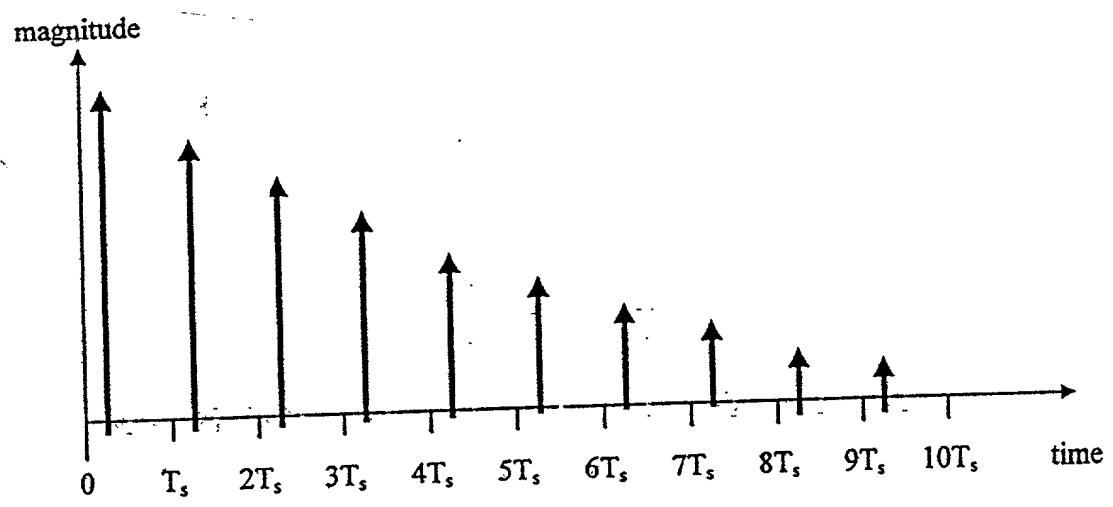


Figure 34

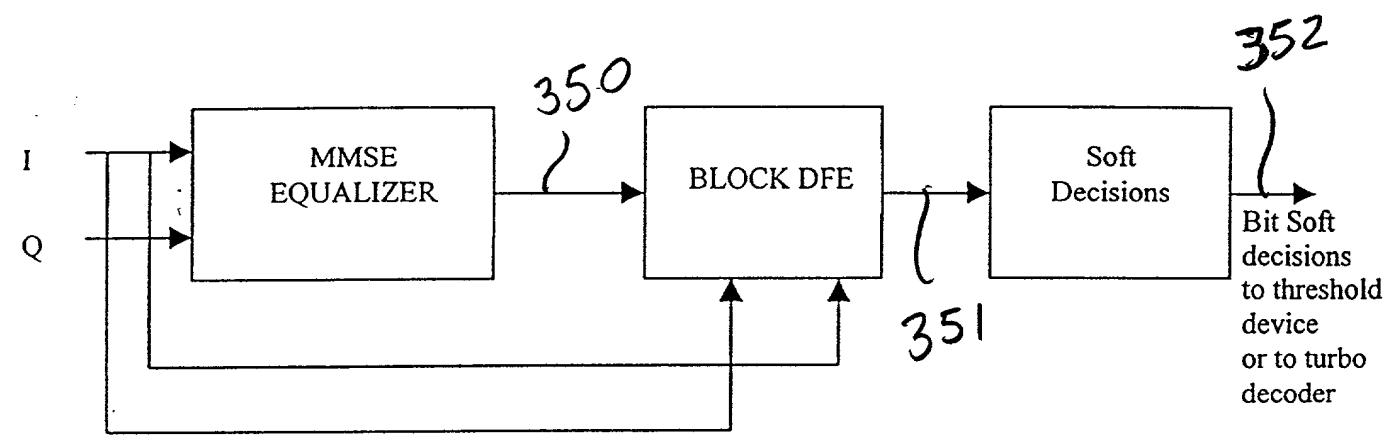


Figure 35

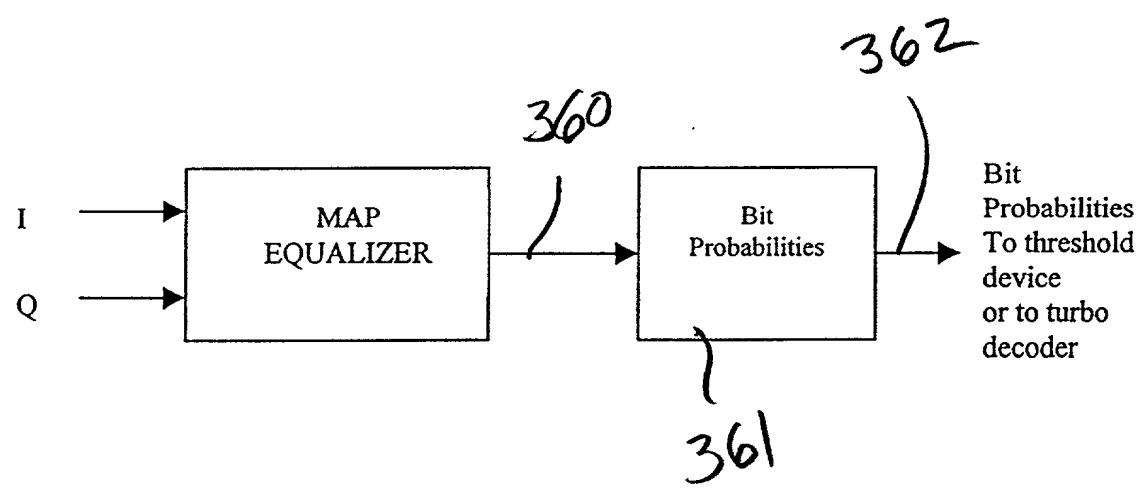


Figure 36

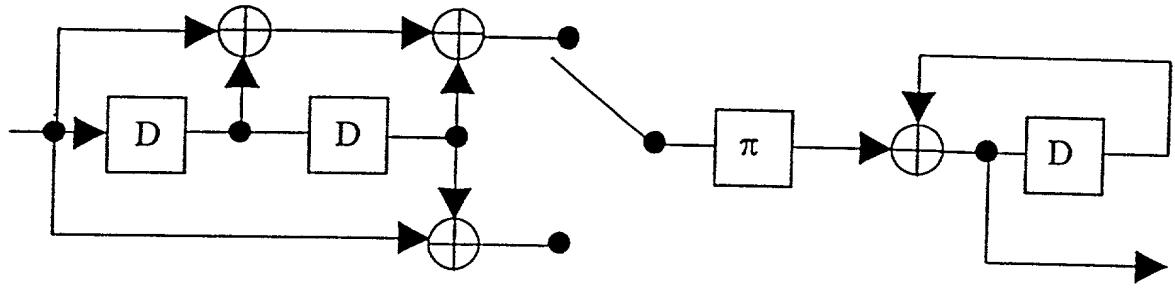


Figure 37

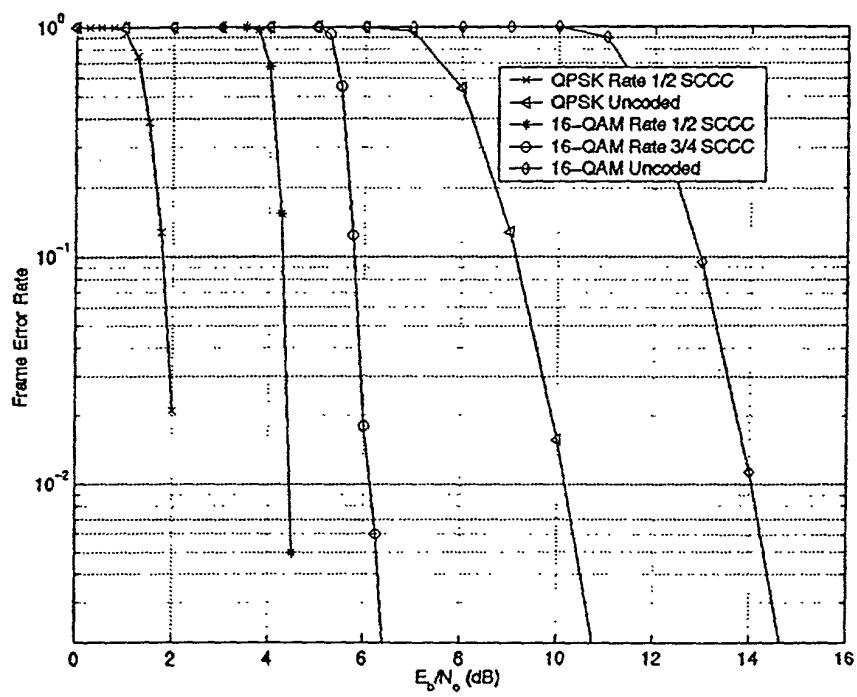


Figure 38

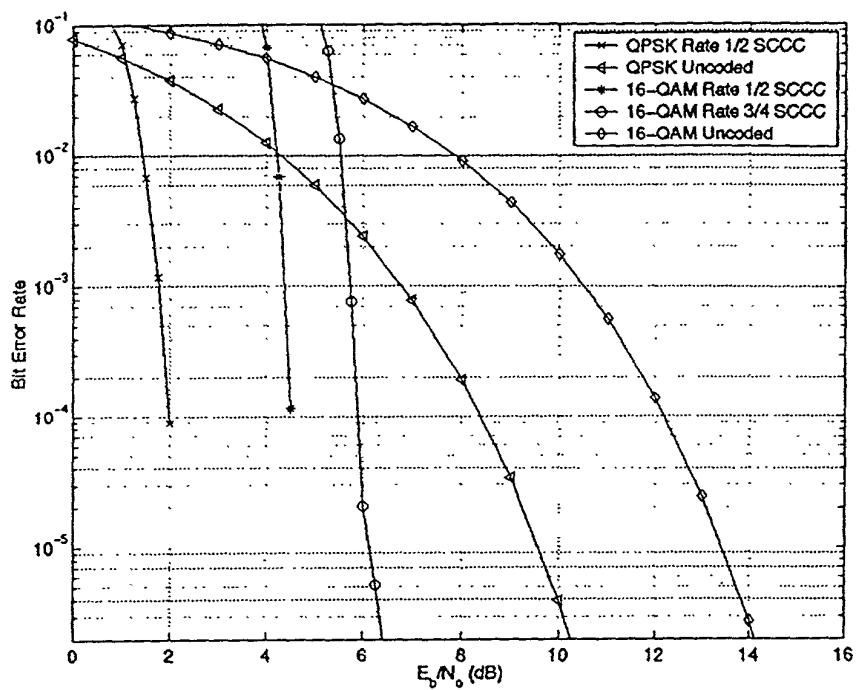


Figure 39

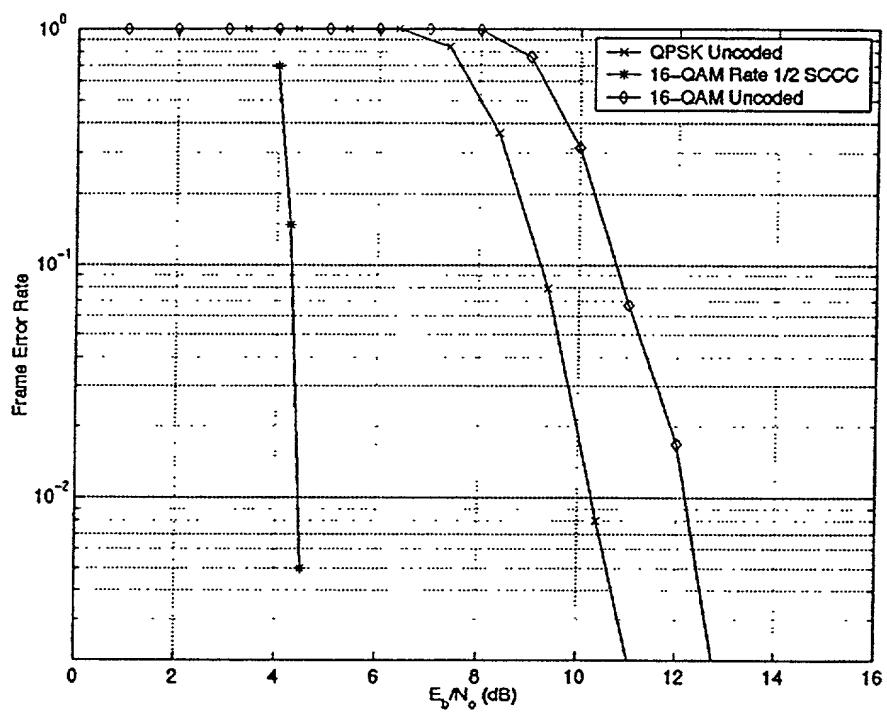


Figure 40

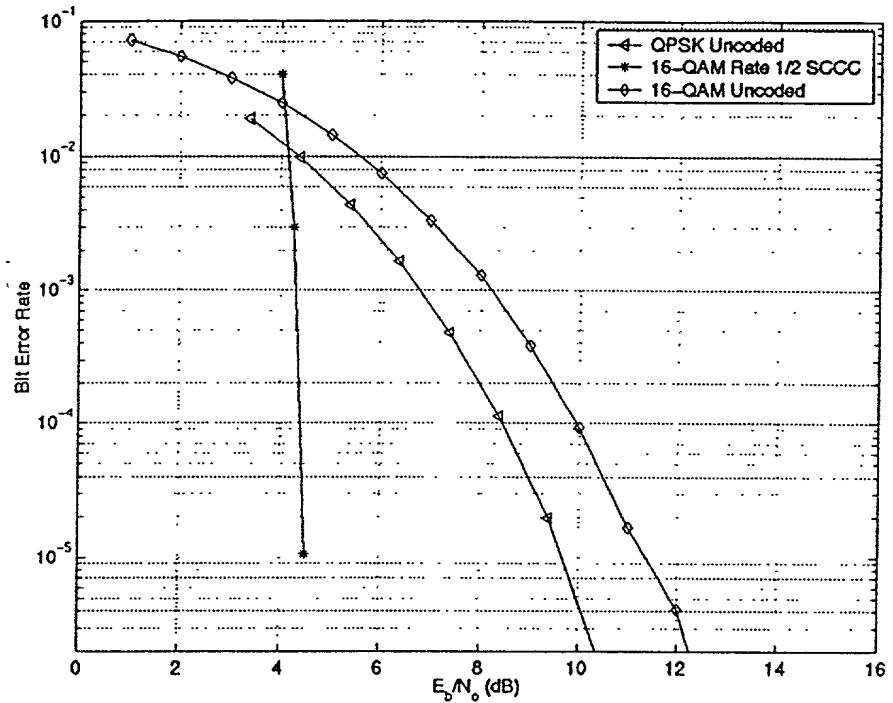


Figure 41

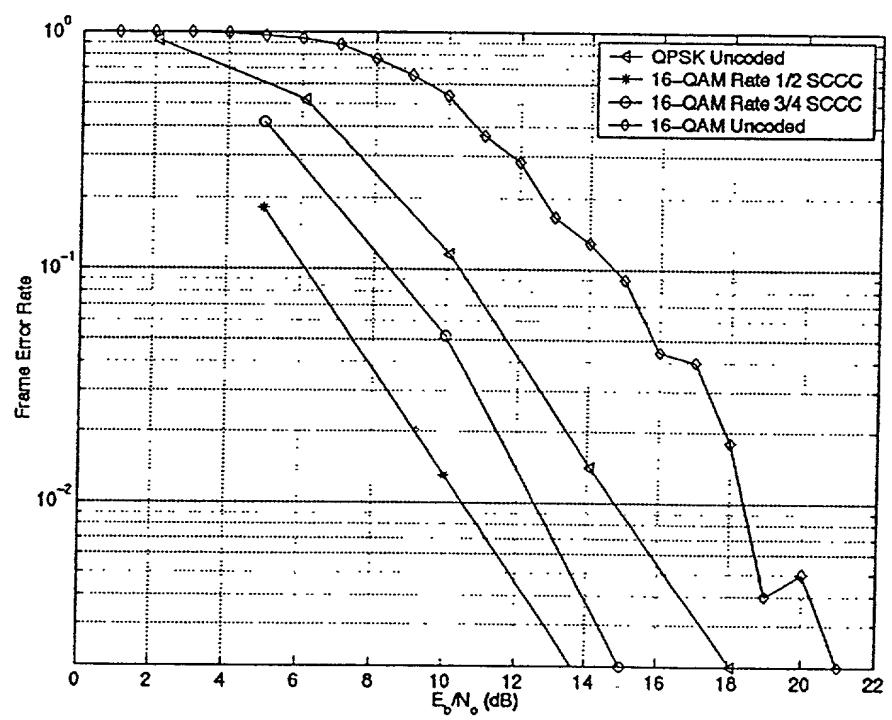


Figure 42

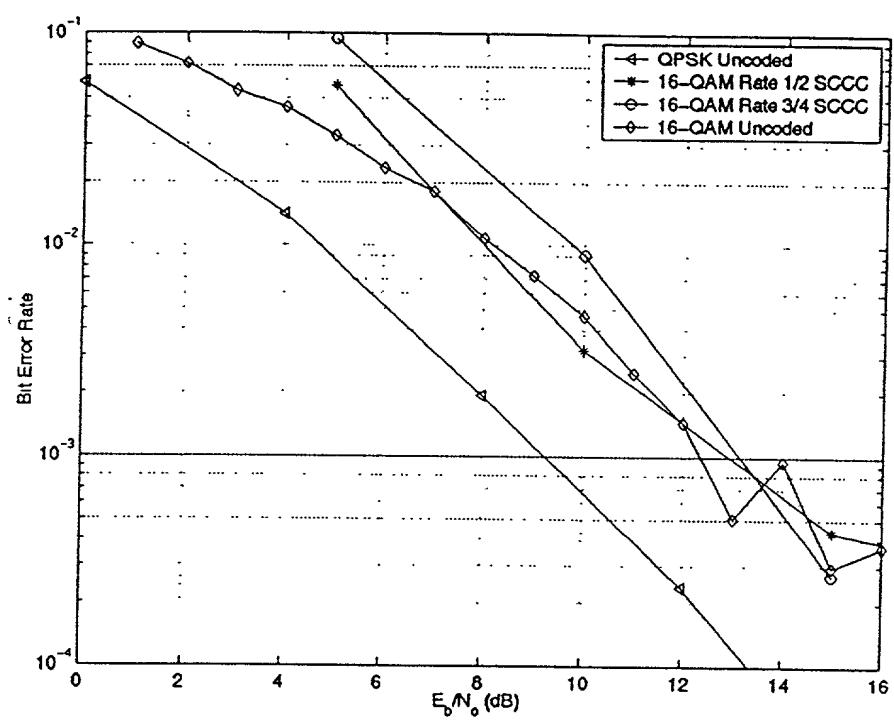


Figure 43

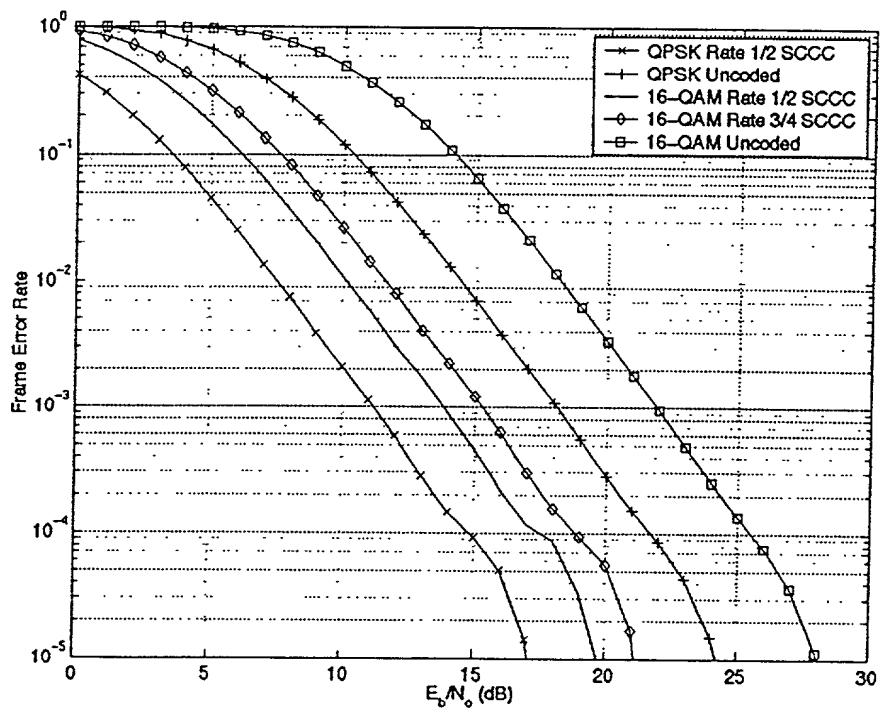


Figure 44